Vol. XIV No. 6

DISSERTATION ABSTRACTS

(formerly MICROFILM ABSTRACTS)

A GUIDE TO DISSERTATIONS AND MONOGRAPHS AVAILABLE IN MICROFORM

$6.00 PER YEAR
$1.50 SINGLE COPIES

DOCTORAL DISSERTATION SERIES

Cooperating Institutions

University of Arizona

University of Arkansas

Boston University School of Theology

Bradley University

Brown University

Bryn Mawr College

University of Buffalo

The Claremont Graduate School

Clark University

Colorado State College of Education

Columbia University

University of Connecticut

Cornell University

University of Florida

Florida State University

George Peabody College for Teachers

University of Illinois (including Chicago Professional Colleges)

Indiana University (including the Graduate Schools of Education and Music)

State University of Iowa

University of Kansas

Lehigh University

Louisiana State University

University of Michigan

Michigan State College

University of Minnesota

University of Missouri

University of Nebraska

University of New Mexico

New York University

Northwestern University

University of Notre Dame

University of Pennsylvania

The Pennsylvania State University

University of Pittsburgh

Princeton University

Purdue University

Rutgers University

St. Louis University

University of South Carolina

Stanford University

Syracuse University

Vanderbilt University

University of Virginia

Virginia Polytechnic Institute

Washington University

University of Washington

Wayne University

Yale University

Yeshiva University

Vol. XIV No. 6

DISSERTATION ABSTRACTS

(formerly MICROFILM ABSTRACTS)

A GUIDE TO DISSERTATIONS AND MONOGRAPHS AVAILABLE IN MICROFORM

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1954

LITHOPRINTED IN THE UNITED STATES OF AMERICA BY
CUSHING - MALLOY, INC., ANN ARBOR, MICHIGAN, 1954

INTRODUCTION

DISSERTATION ABSTRACTS is a vital link in the process of publishing doctoral dissertations, since it makes possible the widespread distribution of information concerning the dissertations which are published in their entirety on microfilm, microcards, or microprint.

The degree to which graduate schools in America make use of this publication service, determines the value of DISSERTATION ABSTRACTS as a bibliographical tool. For its fullest use an understanding of the publication procedure is necessary. Briefly this is as follows:

a. The author submits a carefully typed ribbon copy of the manuscript ready for publication without corrections.

b. He also submits an abstract of 600 words or less, accurately describing the contents of the manuscript, as a guide, but not as a substitute for the complete dissertation.

c. Both the abstract and the manuscript must be approved by the candidate's committee and the Graduate Dean as ready for publication.

d. The manuscript is microfilmed and the negative carefully inspected and put in the vault of University Microfilms for storage, where it is kept available for purposes of duplication upon request.

e. The abstract is printed in DISSERTATION ABSTRACTS, which is distributed, both in this country and abroad, to a large number of subscribing libraries as well as to leading abstracting services.

f. The charge for this service is $20.00 irrespective of the size of the manuscript.

g. Anyone, after consulting the abstract and concluding the complete manuscript would be of value, can obtain a microfilm copy from University Microfilms at 1 1/4 cents per page, or as a paper enlargement at 10 cents per page.

There are varying degrees of partial participation in this plan available at the option of the institution. Titles only will be listed in DISSERTATION ABSTRACTS for a charge of $2.00 each. When a university wishes to prepare its own negatives according to certain specified standards, and have that negative stored at University Microfilms where it will be available for duplication, the charge is $12.00, which includes publication and distribution of the abstract and storage of the negative. Conceivably certain institutions will wish not only to prepare their own negatives, but to service copies as well in either microfilm, microcard or microprint. In this instance the abstract will be printed in DISSERTATION ABSTRACTS, and any requests for copies will be forwarded to the servicing institution. Interested institutions should write University Microfilms for further details of this service.

This method separates the two necessary functions of publishing: notification, or the process of informing prospective users of the existence and contents of a manuscript and distribution, or the furnishing of a copy upon demand. Each of these functions pays its own way, since if no one wishes a copy, the investment is small. However, if there is a demand, copies can be produced at current book rates.

It is anticipated that by enlarging the scope of DISSERTATION ABSTRACTS this publication will become of increasing value to librarians and scholars as a research tool. If this ideal is to be realized, close cooperation between sponsoring institutions, doctoral candidates, and University Microfilms is of the utmost importance. Now that the service is available to all Graduate schools regardless of the way its candidates publish their dissertations, it is hoped that the goal of a complete bibliography of doctoral dissertations may be realized within the next few years. Institutions are urged to write for further details.

Beginning with Volume XIV, DISSERTATION ABSTRACTS will be published monthly.

CONTENTS

AGRICULTURE

AGRICULTURE, GENERAL

CAMPBELL, JR., George W. A modified accounting system for improved marginal analysis of the farm business. 891

DOWNEN, Morris Lloyd. A study of the Milk Market of Memphis, Tennessee. 892

DUNBAR, John Orval. An appraisal of national forage and livestock incentive programs for adding stability to farm incomes. 892

HUNTER, Elmer C. The future of the livestock industry in the Great Plains and range livestock areas. 893

KEOGH, Joseph Lloyd. A study of soil testing methods for Minnesota soils. 894

ROWE, Gordon A. Improving labor productivity in bottling milk. 894

WILLIAMS, Gerald Gordon. A study of the effects of soil moisture upon plant growth and phosphorus uptake. 895

WOOD, V. Alfred. Public land policy for Alberta. 896

AGRICULTURE, ANIMAL CULTURE

JONES, Russell Kay. Some immunological studies on hog cholera. 896

LIVINGSTON, Hugh Gibson. Pasture investigations with special reference to the feeding behavior of the dairy cow. 897

METTA, Venkata Chalam. A study of some factors affecting protein utilization with particular reference to the protein-depleted rat. 897

WHEELER, Richard Ferman. The effect of an antibiotic and a mixture of antibiotics upon the quality, physical and chemical composition of pork carcasses and cuts. 898

AGRICULTURE, PLANT CULTURE

ANDREWS, John Edwin. Inheritance of reaction to loose smut and to stem rust in barley. 899

BERAHA, Louis. An investigation on the environmental factors affecting the development of Puccinia asparagi DC. 900

CURL, Elroy Arvel. Natural availability of oak wilt inocula. 900

FORSBERG, Junius Leonard. The Fusarium disease of gladiolus. 901

LANGSTON, Ruble George. The reproductive physiology of plants with special reference to peppermint. 901

MOHAMED, Aly Hamed. Association tests between chromosomal interchanges in maize and tender pericarp in sweet corn. 902

NEWSOM, Donald Wilson. Some studies on the effects of the incorporation of certain growth stimulants in pelleted seed on germination and development of the seedlings. 903

OMAR, Abdel-Aziz Mostafa. Inheritance of reaction to race 15B and some other races of stem rust of wheat. 903

RACHIE, Kenneth Owen. Winter hardiness of birdsfoot trefoil strains and varieties. 904

SCHAIBLE, Lester William. Some aspects of resistance to cucumber virus 1 in cucumber and squash. 904

SEMEL, Maurie. A study of concentrate spraying of apple trees with the Cornell experimental rotatable outlet mist concentrate sprayer. 905

ANATOMY

JARABAK, Joseph Rudolph. Some observations on the effects of condylar resection on the growth of the face and cranium of the white rat. 906

BACTERIOLOGY

BOUCHER, JR., Norman Edward. The effects of radioactive phosphorus (P^{32}) and cortisone upon the response of mice to transplanted mouse mammary cancer. 907

COTY, Vernon Frank. Tricarboxylic acid cycle reactions in Streptomyces griseus. 907

GREENBERG, Richard Aaron. Studies on an autolytic substance produced by an aerobic spore forming Bacterium. 908

LaBAW, Glenn Douglas. The effect of naturally occurring plant constituents on the heat resistance of food spoilage organisms. 909

MOYED, Harris S. Pyruvate and lactate oxidizing enzymes of Proteus vulgaris. 910

STREISINGER, George. Inheritance and phenotypic expression of type difference characters in bacteriophage. 910

BIOLOGY - GENETICS

Bastian, James Winslow. Studies on the control of ovulation. 911

BRUST, Manfred. Growth and some metabolic aspects of larvae of the blow-fly Phormia regina (Meig.) on sterile media. 912

GLASS, Arthur Warren. An analysis of the heterosis encountered in laboratory crosses. 913

LIPKE, Herbert. The effect of diets containing corn or soybeans on the growth of Tribolium confusum Duv. and Tenebrio molitor Linné. 913

PALM, John Daniel. Detection of the gene for Huntington's chorea. 914

BOTANY

CLARY, Gerald. A study of the inheritance of expansion in popcorn. 915

GREEN, JR., Ralph J. An investigation of the wilting phenomenon in Verticillium wilt of tomato Lycopersicum esculentum Mill. 915

LUCK, John Vergil. Studies on the Verticillium wilt of Mentha piperita L., with special emphasis on the causal organism, Verticillium albo-atrum R. & B. 916

NELSON, Richard Robert. Studies on Stemphylium leafspot of alfalfa. 917

CHEMISTRY

CHEMISTRY, GENERAL

BIERSTEDT, JR., Paul Emmanuel. The effects of high energy radiation on non-aqueous systems. 918

BODNAR, Stephen John. I. Some quantitative and qualitative analytical applications of a new Geiger counter x-ray diffractometer. II. An x-ray investigation of some unsolved sugar problems. III. The reactions of solutions of molybdenum carbonyl in oil on metal surfaces. 918

MARFORI, Ricardo Taningco. Spectrographic determination of zinc in plant materials. 919

NORTON, William T. Studies in the Diels-Alder reaction with nitroölefins and unsymmetrical butadienes. 920

TOREN, Paul Edward. Formation and stability of some complexes of iron and vanadium. 921

CHEMISTRY, BIOLOGICAL

ALAMERCERY, Jacques Marie. Interactive effects of coumarin, dithiooxamide, ascorbic acid and auxins upon the early development of roots. 921

MOORE, Blake William. Part I: An investigation of some biochemical properties of the dental plaque. Part II: The synthesis of some N-stearoyl derivatives of amino acids and related compounds as possible inhibitors of dental caries. 922

POLLOCK, James Marshall. The biochemical functions of soy flour in white bread production. 922

SMUCKER, Arthur Allan. Studies on the metabolism of certain steriods by liver protein fractions. 923

TONZETICH, Joseph. Adenosinetriphosphatase in the red and the white muscle. 924

WALDEN, Cecil Craig. Purification of wheat alpha- and beta-amylases. 924

WILKINS, Donald Harry. Spectrophotometric study of some metal chelate complexes. 925

CHEMISTRY, INORGANIC

ENGELBRECHT, Robert Max. Precise pH measurements with the high resistance glass electrode. 925

GORDON, Paul Gene. Compounds of high nitrogen content. 926

GUTH, Eugene Daniel. A phase study of the praseodymium oxide system and the terbium oxide system. 927

WAY, John William. I. The synthesis and reactions of o-quinonedibenzimide II. The structure of dichlorodimethoxybenzidine-dibenzenesulfonamide. 927

CHEMISTRY, ORGANIC

BRINK, David Liddell. The Cooking Process: XIII. The effect of aqueous solutions of pure sodium hydrosulfide on the constituents of wood. 928

CAVALIERI, Liebe Frank. Synthesis of some pyrone, chromone and coumarin derivatives. 929

CONRAD, Harry Edward. Oligosaccharide fragments from okra mucilage. 929

GENTRY, JR., Robert Edgar. A 2-pyridine analog of chloromycetin. 930

HEITMILLER, Richard Frank. The reductive coupling reaction and the binary mixture of Gomberg and Bachmann. 930

STEINER, Edwin Charles. Reactions of vinyllithium compounds. 931

CHEMISTRY, PHYSICAL

BAGLEY, Edward Brownell. The anomalous diffusion of organic vapors in high polymers. 932

BLACK, Edward Daniel. Polarography with platinum microelectrodes in LiCl-KCl and in $LiNO_3$ - $NaNO_3$ - KNO_3 melts. 932

FLEMING, Sydney Winn. Detection of free radicals from the heterogeneous decomposition of butane by a tracer technique. 933

GINDLER, James Edward. The photo-fission of heavy elements. 934

KROON, James Lee. A new millicoulometer for the study of the polarographic reduction of organic compounds. 934

LEIGHTON, JR., Frederick. The mechanism of the reaction between nitrosyl chloride and ozone. 935

MARTIN, Robert Eliot. Studies on hydrogen chloride. I. The exchange reaction between tritium hydride and hydrogen chloride in a glow discharge. II. Red hydrogen chloride: an impurity color center. 936

WOLKE, Robert Leslie. Yields and excitation curves for some high energy photospallation reactions of cobalt. 937

ECONOMICS

ECONOMICS, GENERAL

BENEWITZ, Maurice Charles. Economic factors in migration to St. Paul, Minnesota, 1940-1950. 937

CHEN, Chi-Ta. The awards of the National Railroad Adjustment Board. 938

MENDUKE, Hyman. Shares of the upper income groups in income by states, 1919, 1929, 1933 and 1937. 938

RORHOLM, Niels. Linear programming as a possible refinement of farm budgeting techniques. 939

TRECKEL, Karl Frederick. Economic aspects of old-age assistance in the state of Ohio. 940

ECONOMICS, AGRICULTURE

SMITH, Raymond Claris. Factors affecting consumer purchases of frying chickens. 940

ECONOMICS, COMMERCE - BUSINESS

ZOOK, Paul David. Local and feeder airlines and public policy. 941

EDUCATION

EDUCATION, GENERAL

DAVIDSON, James Wayne. Construction and appraisal of procedures and materials for developing consensus regarding music education programs. 942

ROESSEL, Fred Paul. Minnesota Multiphasic Personality Inventory results for high school drop-outs and graduates. 942

EDUCATION, ADMINISTRATION

BUFFINGTON, Reed Lawrence. The job of the elementary school principal as viewed by parents. 943

CIESLAK, Edward Charnwood. A study of administrative and guidance practices for students from abroad in representative collegiate institutions of the United States. 944

McDONALD, Walter Hastings. The application of the geographic method to school district reorganization in Union County, Illinois. 945

MEDSKER, Leland Leon. The job of the elementary school principal as viewed by teachers. 946

NELSON, N. LeRoy. The administrative activities and practices of twenty Iowa county superintendents. 947

NICHOLSON, Howard Mortvedt. A plan for educational development in a California community. 947

PRINCE, Donald Mattison. Administration of special services in community schools: a study of factors related to community unit superintendents' concepts of administration of selected special services and an investigation of the administrative structure for their provision. 948

SHIPNUCK, Murray Ellis. Perceived hostility in administrator-teacher relationships. 949

SOBEL, Morton J. An analysis of social studies textbooks in regard to their treatment of four areas of human relations. 950

EDUCATION, PHYSICAL

BALL, Edith Louise. A study of recreation functions and personnel in selected private agencies: to determine the implications for the selection and preparation of personnel by the colleges and employment of the personnel by the agencies. 951

EDUCATION, PSYCHOLOGY

MANBECK, Maurice Wesley. A study of critical incidents in effective secondary school teaching as conceived by pupils and faculty. 952

EDUCATION, TEACHER TRAINING

ELEQUIN, Eleanor Tengonciang. A study of the effectiveness of the student personnel services and adequacy of guidance and related course offerings for teacher training at Philippine Normal College. 952

EDUCATION, THEORY AND PRACTICE

COLLINGS, Miller Raymond. Children's procedures in interpreting reading matter accompanied by maps. 953
WILSON, Lois Mayfield. Henry Philip Tappan's conceptions of the structuring of university functions. 954
WOODS, Robert Keith. Number rearrangement as arithmetical learning. 955

ENGINEERING

ENGINEERING, GENERAL

KILBRIDGE, Maurice D. The management of wage incentives. 956
LOHMANN, Melvin R. A concept of organization and management. 956

ENGINEERING, CHEMICAL

SAXTON, Ronald Luther. I. Diffusion in liquid sulfur. II. Effect of temperature in thermal diffusion. 957
UHL, Vincent William. Heat transfer to viscous materials in jacketed agitated kettles. 958

ENGINEERING, CIVIL

EKBERG, JR., Carl Edwin. An investigation of the two-way prestressed concrete slab. 958

ENGINEERING, ELECTRICAL

WADIA, Behram H. The influence of positive ions on electron-beam profiles. 959

ENGINEERING MECHANICS

ARNOLD, Frank Robert. Steady-state oscillations in nonlinear systems of two degrees of freedom. 959
GEYLING, Franz Thomas. A general theory of deformations of membrane shells. 959
JAHSMAN, William Edward. Elastic wave propagation and vibrations in plane stress and flexure. 960
ZAJAC, Edward Eugene. Flexural waves in beams. 961

ENGINEERING, METALLURGY

ANDERSON, Paul Herman. Theory of nodular graphite formation in ductile cast iron. 961
DeMONEY, Fred William. Dynamic creep, stress-rupture, fatigue properties and fracture characteristics of rolled aluminum alloy 24S-T4 at elevated temperatures. 962

FINE ARTS

CAMPBELL, Susan Margaret. The poetry of Thomas Merton: a study in theory, influences, and form. 962
STAFFORD, William Edgar. Winterward. 963

FOOD TECHNOLOGY

HU, Kwoh Hsien. Investigation of the use of plastic containers for heat processed foods. 964
PAN, Huo-Ping. Some carbohydrate derivatives of higher fatty acids. 964

GEOGRAPHY

WILKINS, Ernest J. The industrial aspects of Argentina's Five-Year Plan: why it did not succeed. 965

GEOLOGY

HURLEY, Neal Lilburn. Groundwater motion and its relation to oil accumulation. 966
WHITE, David Archer. Stratigraphy and structure of the Mesabi range, Minnesota. 966

HEALTH SCIENCES

HEALTH SCIENCES, NURSING

FONG, March Kong. Factors related to school dental hygienists' positions in California. 967

HISTORY

HISTORY, MEDIEVAL

EIDELBERG, Shlomo. The responsa of Rabbi Gershom Ben Judah Me'or ha-Golah: as a source of the history of the Jews in France and Germany from the second half of the tenth century to the first half of the eleventh. 968

HISTORY, MODERN

ERIKSON, Elliot. Karl Marx and the Communist Manifesto. 969

JOHNSTON, Charles Murray. Charles Jenkinson, Lord Hawkesbury, at the Committee for Trade, 1784-1792: a study in commercial and colonial policy. 969
KINZER, Donald Louis. The American Protective Association: a study of anti-Catholicism. 970

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

EATON, Sister Mary Eleanor. The use of scripture by the English mystics. 971
FINK, Jack Elliot. St. Evremond in the French and English critical traditions. 971
GRUBER, Christian P. The education of Henry Thoreau, Harvard 1833-1837. 972
KEELER, Clinton Clarence. The Grass Roots Of Utopia: a study of the literature of the agrarian revolt in America, 1880-1902. 973
RICHTER, Bodo L. O. The place of the minor Italian poets in the works of Ronsard and du Bellay. 973

LANGUAGE AND LITERATURE, MODERN

BOBB, Sydney Ralph. Fighter Against Loss: the Hemingway hero. 974
EDDY, Frederick Daniel. Principles governing affinity between the members of intervocalic pairs of consonants in French. 974
EICHEL, JR., Clyde William. Sully Prudhomme; an intellectual biography: a struggle for idealistic reconstruction in the age of Positivism. 975
IVASK, Ivar Vidrik. Hofmannsthal als Kritiker der deutschen Literatur. 976
MUNZER, Hans Wilhelm. Das Liebes- und Todesproblem bei Johann Christian Günther. (The problem of love and death in the works of Johann Christian Günther). 977
NURMI, Martin Karl. Blake's doctrine of contraries: a study of visionary metaphysics. 977
SMITH, S.S.J., Sister Marie Emily. A biographical and critical study of Dora Sigerson Shorter (1866-1918). 978
SOBOLEVITCH, Serge. L'emploi de la mythologie classique dans le théâtre français de 1870 à 1950. 979

LANGUAGE AND LITERATURE, LINGUISTICS

LUDLUM, JR., Charles Daniel. A critical commentary on the vocabulary of the Canterbury Psalter. 979

MATHEMATICS

ALLEN, JR., Stephen Gatchell. A class of minimax tests for one-sided composite hypotheses. 981
BAXTER, Glen Earl. An application of stochastic processes to certain problems in the Brownian motion of continuous media. 981
JOHNSTON, Ernest Raymond. A study in polynomial approximation in the complex domain. 981

MINEROLOGY

LEPP, Henry. An experimental study of interconversions among iron carbonates, oxides, and sulfides. 983

MUSIC

PEITERSEN, Dana Norman. An experimental evaluation of the transfer effects of rhythm training in spaced notation on subsequent reading of commercially printed music. 983
REA, Ralph Curtis. An experimental program for improving the sight-reading ability of cornet and clarinet players. 984

PHARMACOLOGY

FEURT, Seldon Dick. A pharmacological study of Serenoa repens (Bartram) Small berries. 985
JOHNSON, Henry Douglas. Experimental production of hypertension in the rat and a practical apparatus for recording the rat's blood pressure. 985
LEVY, Bernard. The influence of various agents upon the depth and duration of morphine analgesia in rats. 986
NASHED, Wilson. The development of medicinal membranes containing ion exchange adsorbates. 986
SANTOS-MARTINEZ, Jesus. A study of the hypotensive action of Polypodium polypodioides. 987

PHILOSOPHY

LINNELL, John S. Berkeley's criticism of abstract ideas. 987

PHYSICS

PHYSICS, GENERAL

DEVERALL, George Victor. Some contributions to atomic beam spectroscopy. 988

LEHMAN, Guy Walter. Interaction of impurities and mobile carriers in semiconductors. 988

STILLWELL, George Keith. The evaluation of the errors involved in the measurement of surface temperatures with thermocouples affixed to the surface by adhesive tape. 989

ZISSIS, George John. Precision interferometric measurements using an atomic beam light source. 989

PHYSICS, ELECTRONICS AND ELECTRICITY

CARTER, JR., Philip Staats. High-frequency airborne direction-finding. 990

PHYSICS, NUCLEAR

FECHTER, Harry Robert. High energy electron scattering from atomic nuclei. 990

PHYSIOLOGY

BUSKIRK, Elsworth Robert. Relationships in man between the maximal oxygen intake and components of body composition. 991

CHRISTENSEN, Eleanor. Photoreactivation in Tetrahymena geleii. 992

FINAMORE, Frank Joseph. A study of ribonuclease and desoxyribonuclease during the early developmental stages of Rana pipiens. 992

HARVEY, Rodney Bryce. Some factors influencing the renal excretion of sodium. 992

ROVELSTAD, Randolph Andrew. Factors influencing the continuous recording of the in-situ pH of gastric and duodenal contents in normal persons and patients with duodenal ulcer. 993

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

BRAZIER, Gary Philip. Intergovernmental relations in the field of public airports in Minnesota with special reference to relations between the State Department of Aeronautics and the Metropolitan Airports Commission. 994

La PALOMBARA, Joseph Guido. Democratic trade unionism in postwar Italy. 995

LYON, Richard Martin. The legal status of American and Mexican migratory farm labor: an analysis of U. S. farm-labor legislation, policy and administration. 995

RANSOM, Harry Howe. The Air Corps Act of 1926; a study of the legislative process. 996

PSYCHOLOGY

PSYCHOLOGY, GENERAL

STEVENS, Samuel Nowell. Development of a personality test for executive selection. 997

PSYCHOLOGY, CLINICAL

POWERS, Mabel Kathryn. A longitudinal study of vocational interests during the depression years. 997

SHIPPEE, Eva Maria. Ego-structure of rebellious adolescents: an experimental study of the dynamics and etiology of asocial behavior. 998

WILCOX, Katherine Washburn. Intellectual functioning as related to electroconvulsive therapy. 999

PSYCHOLOGY, EXPERIMENTAL

BLOCK, James David. Blood changes during emotional stimulation in the goat. 1000

REYNOLDS, Gerald A. Perceptual constancy in schizophrenics and "normals". 1000

SMITH, Bertram Joseph. Validation of certain tests of ocular dominance against a criterion of bombsight design preference. 1001

SWANSON, Robert Alden. The relative effectiveness of differing visual presentations of a complex aircraft system in three learning situations. 1001

SWEENEY, Edward Joseph. Sex differences in problem solving. 1002

WINER, Harold R. Incidental learning in schizophrenics. 1002

RELIGION

SELBY, Donald Joseph. The pre-literary development of the kerygma. 1003

SOCIOLOGY

SOCIOLOGY, GENERAL

TAVES, Marvin Jacob. A study of social factors associated with religiosity among a sample of college employees. 1004

SPEECH - THEATER

COHEN, Herman. The rhetorical theory of Hugh Blair. 1004

DAHLE, Thomas Locke. An objective and comparative study of five methods of transmitting information to business and industrial employees. 1005

HAWES, David Stewart. John Brougham as American playwright and man of the theatre. 1006

SHARP, William Leslie. The relation of dramatic structure to comedy in the plays of George Bernard Shaw. 1007

ZOOLOGY

CURRY, La Verne Leon. An ecological study of the family Tendipedidae of two fresh-water lakes in Isabella County, Michigan. 1008

SHALABY, Abdel Salam Mahmoud. A study of the mouth parts of certain mosquito larvae and their importance in taxonomy (Diptera: Culicidae). 1008

AGRICULTURE, GENERAL

A MODIFIED ACCOUNTING SYSTEM FOR IMPROVED MARGINAL ANALYSIS OF THE FARM BUSINESS

(Publication No. 8032)

George W. Campbell, Jr., Ph. D.
Purdue University, 1954

Major Professor: L. N. Hardin

This study formulates a modified accounting and analysis system that furnishes data appropriate for use of marginal analysis theory in farm planning.

Agricultural progress in the United States has resulted in the farm business becoming increasingly complex. Dependence upon more and more external factors of production necessitates evaluating the cost of using these factors and the contribution of each of these factors to the well being of the farm family. Existing record and analysis systems furnish data that often lead to erroneous conclusions when used in farm planning. Much of the resulting confusion is attributed to the calculation and the use of "net" and "average" costs and revenues in planning. Logic suggested that a system of accounting and analysis specifically designed to yield results applicable to the use of marginal analysis theory in farm planning would lessen misconceptions and confusion.

The primary purpose of this study is to provide farmers, teachers, researchers, and students with additional farm management tools, analysis techniques, and avenues to knowledge so their means-ends schemes can be improved. Formulation of the proposed accounting and analysis system is secondary to this main purpose.

The Analytical Model

The analytical model (Chapter II), (1) furnishes a mental picture of the qualitative and quantitative relationships involved, (2) suggests conditions which must hold for maximizing profits, and (3) indicates data necessary for realizing these conditions. The farmer usually lacks resources to produce quantities that equate marginal costs and marginal revenues (maximum profit conditions). With limited resources optimum output is achieved when marginal returns from all resources are equated.

Ideal data would give complete knowledge of all output-input relationships and prices to be paid and received by farmers. Practical data should be the nearest possible approximation of the ideal.

Available data from all sources must be particularized for the individual farm and its operator. In so far as the memory of farmers is faulty, records make these particularized data available for planning (Chapter III). A system of record keeping designed to yield the data needed was developed.

Inputs are classified as fixed or variable, cash or non-cash, operating or non-operating, direct or indirect, and allocatable or unallocatable. Inputs are recorded in enterprise accounts, the general farm account, or the joint farm-home account. Allocatable general farm inputs are apportioned among the enterprises. Outputs are classified as cash or non-cash and are credited to the pertinent enterprise account or general farm account (Chapters IV and V).

Calculating Measures of Earnings

The "value of production above variable costs" is considered the most important earnings measure. It is equal to: total receipts plus value of goods transferred out plus or minus net inventory change, less total variable cash expenses less value of inputs transferred in (Chapter VI).

Analysis of A Case Farm Business, 1952

Expected, actual, past, and potential case farm productions are analyzed and the results incorporated in 1953 plans (Chapter VII).

Planning The Case Farm Business, 1953

Within the framework imposed by fixed conditions various alternative plans are budgeted. Primary consideration is given to variable and added fixed costs and value of outputs. The most profitable plan is that which results in the greatest value of production above variable and added fixed costs for the farm as a whole (Chapter VII).

Conclusions

Replacing "net revenues" with "value of production above variable costs" as the criterion of economic success lessons confusion and errors resulting from erroneous allocation of overhead costs. Planning is simplified by excluding fixed costs which remain unchanged during the production period. Based upon the limited tests made on the new system to date, it appears that the system will be useful in self-analysis and education, teaching and research. Further testing is, however, desirable.

153 pages. $1.91. MicA54-1308

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

A STUDY OF THE MILK MARKET OF MEMPHIS, TENNESSEE

(Publication No. 8038)

Morris Lloyd Downen, Ph. D.
Purdue University, 1954

Major Professor: C. E. French

This study of the Memphis, Tennessee Milk Market was undertaken with the following objectives:

1. Describe the market in terms of population, incomes, employment, and various indicators of economic activity.
2. Examine and describe the role of the various institutions in the market.
3. Analyze the demand for milk and milk products distributed by fluid milk dealers in terms of:
   (a) Trends in sales of fluid milk products.
   (b) Sales responses to changes in retail milk prices.

Memphis is the largest market for fluid milk in Tennessee. The estimated population of the market area served by Memphis distributors increased from about 356,000 in January 1943 to nearly 488,000 in December 1952, or approximately 1,1000 per month. The population increase was accompanied by an increase in total Class I sales but per capita sales did not appear to change materially.

The Memphis Milk Market has within it a number of organizations exerting influence on the complex of problems which exist in a fluid milk market. The most important of these include the Mid-South Milk Producers Association, the Memphis Dairy Exchange, the Memphis-Shelby County Health Department, the Federal Order of the Memphis Milk Marketing Area, and the Memphis Dairy Council.

Total sales of Class I milk in the Memphis Market ranged from about 3,250,000 quarts equivalent to 5,750,000 quarts equivalent per month from 1943 through 1952. Daily average sales ranged from about 100,000 to 186,000 quarts equivalent.

The sales of homogenized milk, Bulgarian buttermilk, skim milk and special creams were relatively more important in 1952 than in 1943, while standard milk, extra rich milk, plain buttermilk, chocolate milk and light cream were less important. In 1943, sales of standard milk accounted for about 63 percent of Class I sales compared with 34 percent in 1952. Extra rich milk sales declined from nearly 21 percent of Class I in 1946 to about 2 percent in 1952. Homogenized milk, which was introduced on the Memphis Market in 1947, accounted for 43 percent of Class I sales in 1952.

The combined sales of the sweet whole milk products – standard, homogenized and extra rich milk – accounted for 75 to 80 percent of total Class I sales during the period studied. The three most important products in 1952 were homogenized milk, standard milk, and plain buttermilk, accounting for nearly 90 percent of Class I sales.

There was significant seasonal variation in daily average Class I sales and in the sales of most of the fluid milk products. Generally sales were highest during the fall and winter and lowest in the spring and summer. Seasonal variations in sales were greatest for light and heavy cream, and each had two peak sales periods. The spring peak probably was associated with Easter and the fresh strawberry season; the December peak with the Christmas-New Year holidays.

Sales responses to price change were analyzed by comparing daily average sales in quart containers during the month before and the month after a price change. The effects of trend and season were removed. For each product it was found that price change had no significant effect on daily average sales. The effect of price change on daily average sales of light and heavy cream in one-third quart and one-half pint containers was also analyzed. There was no significant effect of price change on sales of heavy cream, but the results indicated that a 10 percent change in price for light cream was followed by a change in sales of about 1.4 percent in the opposite direction. This response was small but significant.

237 pages. $2.96. MicA54-1309

AN APPRAISAL OF NATIONAL FORAGE AND LIVESTOCK INCENTIVE PROGRAMS FOR ADDING STABILITY TO FARM INCOMES

(Publication No. 8039)

John Orval Dunbar, Ph. D.
Purdue University, 1954

Major Professor: J. Carroll Bottum

One idea proposed as a solution to the farm price and income problem is forage and roughage consuming livestock incentive payments. This study was made to (1) examine effects of these payments and increased grass (2) develop an agricultural program embracing this idea, and (3) appraise its consequences.

The budget procedure was used to estimate production, price, and income changes with increased grass. Economic theory and the history of agricultural policy were used in developing the proposed program.

Ten percent more grass would reduce aggregate grain acreage about 5 percent. Grain production would be reduced, but not as much as acreage. Using better land and more fertilizer would increase yields. Livestock marketings would be reduced while herds were built up to eat increased grass.

Assuming an inelastic demand for food, reduced marketings would increase farm prices more than proportionately. Farm incomes would increase if assumptions made here are correct.

More grass would probably increase grain yields. This would increase food production with small grass increases. Again, assuming an inelastic demand for food, this would probably reduce farm prices and incomes.

Beef production per calorie takes about 4 times as

many feed units as pork. With large shifts to grass, more than 30 percent, this could cause reduced total food production.

With thin pocketbooks, people tend to eat more cereals and less meat, creating calorie surpluses which curtailed grain production helps offset. With relatively more livestock, meat prices would fall relative to grain. Consumers could more nearly maintain high-income level diets. More beef and milk generally improve diet quality.

Increased grass reduces soil exploitation. Stores of soil fertility and cattle would be built up to draw upon during emergencies.

Based upon the assumptions of this study, incentive payments required to get 10 percent more grass at 1949 price levels and relationships would be $7.78 per acre; $10.48 for 20 percent; and $12.69 for 30.

The Income-Incentive Payment Proposal

Maximum adjustment would occur with payments only for acres shifted; but most farmers would receive no payment. Therefore, it is proposed that annual payments be based on tillable acres in grass instead of acres shifted.

Payments per acre would be lowered if based on all grass acres. By making only part of the acreage eligible, payments per acre could be increased.

Acres not eligible would be some fraction of the county average percent in grass.

Here is how to determine acres eligible:

1. You have 100 tillable acres, 30 in grass.
2. Payments will be made on all over half the county average percent in grass. Assume this is 20.
3. Multiply your 100 acres by half of 20. You have 10 acres not eligible for payment.
4. Subtracting 10 from 30 makes 20 acres eligible.

A $400 million payment would make $4.50 an acre based on half the grass acreage. At 1949 prices, this would encourage 6 percent more grass, requiring a $50 million incentive payment. Fifty plus $400 million would make the program cost $450 million.

With prices at 80 percent of parity, about 10 percent more grass would be grown. The program would cost $500 million.

To get 10 percent more grass at 1949 prices would require $7.78 per acre. Payments for half the acres in grass resulted in:

1. Income payments: $700 million.
2. Incentive payments: $137 million.
3. Farm income increase: $489 million.
4. Net program effect on farm incomes: $1,325 million.

No historical grass base would be required. Payments would be made for fallow, too. Permanent pasture payments would be based on cow months.

Some alternative methods for dividing payments among states are (1) land value, (2) acres of grass, and (3) roughage consuming livestock.

With fixed incentive payments, and low grain prices, many farmers might increase grass. With higher prices farmers would shift again to grain.

312 pages. $3.90. MicA54-1310

THE FUTURE OF THE LIVESTOCK INDUSTRY IN THE GREAT PLAINS AND RANGE LIVESTOCK AREAS

(Publication No. 8042)

Elmer C. Hunter, Ph. D.
Purdue University, 1954

Major Professor: Clifton B. Cox

Low precipitation, severe winter storms and other undesirable climatic phenomena make any type of agricultural enterprise in the 17 Western States extremely hazardous. These climatic conditions make for instability of production within the Western Livestock Industry because of their effects on feed crop and range forage production.

Various agencies of the Federal Government control approximately 50 percent of rangeland in the West. The lack of tenure and the amount of use on these rangelands are major factors as far as the livestock operators are concerned contributing to man-made instabilities of the industry. Federal land administrators have the problem of supervising these public lands in such a way that the public will receive the maximum economic and social returns. The various uses that must be considered are: watershed protection, recreation, timber production, mining, and grazing. Just as the social and economic valuation of these uses is difficult, so is the proper administration of these lands.

The interrelationship between public and private lands on the one hand, and rangeland and cropland on the other, complicates the policy making of the government regarding public lands if overall land use objectives are to be realized. Maximum application of presently known rangeland technologies could increase the livestock carrying capacity as much as 69 percent on the western ranges in the next 25 years but based upon the present and expected management procedures employed on these lands, the increase will amount to approximately 10 percent.

Since 1919, in the West, farmers and ranchers have decreased the acreage devoted to feed production by 8.4 percent but total production of food has increased during the same period by 2.2 percent. When the various trends in soil conservation, acreage controls, reclamation development, and increased urban demands for domestic water and for non-feed crops are examined, it appears that the acreage devoted to feed crops will not increase although production per acre will increase sufficiently to allow for a 10 percent increase in feed production.

With the assumptions used, an analysis would indicate that the following changes could be expected to take place between 1950 and 1975. Cattle numbers in the United States are expected to increase during the next 25 years by approximately 20 percent. Probably sheep numbers during this same period will be practically unchanged from the 1950 inventories (this would be a decline in numbers of sheep from the 1953 inventories). Hog numbers will increase between 15 and 20 percent. Because of the probable increases in production per animal breeding unit, the production of red meats will expand 39 percent - the approximate expected rate of population increase. Since the amount

of money spent on meats will increase more than proportionately, the retail prices of meat will also increase during this period.

The West's population will be a larger percent of the nation's total in 1975 than at present, and its average income per person will probably be higher than the nation's average – thus relatively improving the market for meats in the West. This better market will tend to improve the position of western livestock feeders as will the expected relative increase in the amount of feed grains in the western feed base. The feeding out of livestock in the West will be enlarged materially, but the importance will only be local.

Because one major item of the Western Livestock Industry's resources, i.e., rangeland, is relatively fixed, the opportunity to expand livestock production is limited, but the industry is placed in a favorable position, at least temporarily, because of favorable outside conditions.

241 pages. $3.01. MicA54-1311

A STUDY OF SOIL TESTING METHODS FOR MINNESOTA SOILS

(Publication No. 8124)

Joseph Lloyd Keogh, Ph. D.
University of Minnesota, 1954

The study was designed to evaluate soil testing methods as these would apply to Minnesota soil conditions. Four factors were considered: 1. the procedure to be followed in time for conditioning and drying of soil samples in preparation for testing; 2. the determination of the proper fineness of grinding; 3. a satisfactory method for the determination of available phosphorus under varying soil type conditions, and 4. the refining of testing methods for determining available potash in soils.

Certain procedures have recommended the drying of soil samples at room temperatures for a period of ten days. This has lengthened the time required to test samples and has created problems in the laboratory. It has also delayed the reporting of results to farmers. It was found that by drying soil samples for three days at a temperature of 30° C. equally satisfactory results could be obtained. Drying for the shorter period permitted more satisfactory handling of large numbers of samples.

To test the effect of fineness of grinding the soil samples, after a preliminary crushing, were screened to give three particle size ranges – 8-4 mesh, 4-50 mesh and less than 50 mesh. Using weighed samples and routine testing procedures no significant differences were found between the three groups. From the tests it was concluded that bulk soil samples should be ground to a fineness which will give a mixture from which a uniform test sample may be drawn.

Nine methods for the determination of soil phosphorus were investigated. Several of these were not adapted to rapid testing procedures. On calcareous soils, methods having a strong acid extractant removed larger amounts of the phosphorus than was actually available to the plants. In others, the range in readings between soils with a high level and those with a low level of available phosphorus was too narrow for making satisfactory interpretations. One procedure, the Bray absorbed phosphorus method (1), gave satisfactory results on both acid and calcareous soils and appears to be most adapted to Minnesota soils.

Three methods for the determination of available potash were studied. Two of these, the Bray turbidimetric (2), and the ammonium acetate extraction (3) methods gave the most satisfactory results. The latter method is the most rapid procedure when the readings are made with the flame spectrophotometer.

The methods for both phosphorus and potash were evaluated on soil samples taken from plots in several soil fertility experiments which the Department of Soils, University of Minnesota, has had in progress for a number of years and upon which the fertility levels and the response to chemical fertilizer were known. 103 pages. $1.29. MicA54-1312

REFERENCES

1. Bray, R. H. 1942. Rapid tests for measuring and differentiating between the adsorbed and acid soluble forms of phosphate in soils. Ill. Agr. Exp. Sta. Agron. Dept. A. G. 1028

2. Bray, R. H. 1945. Photometer method for determining available potassium in soils. Ill. Agr. Exp. Sta. Agron. Dept. A. G. 1275

3. Peech, M., L. T. Alexander, L. A. Dean and J. F. Reed. 1947. Methods of soil analysis for soil fertility investigations. U.S.D.A. Circ. 757

IMPROVING LABOR PRODUCTIVITY IN BOTTLING MILK

(Publication No. 8056)

Gordon A. Rowe, Ph. D.
Purdue University, 1954

Major Professor: L. S. Hardin

In 1952, 45 percent of the milk produced in Indiana was utilized in fluid form. Approximately 50 percent of the labor costs of processing fluid milk are incurred in the bottling process.

Operations in the bottling process – the loading, washing, casing and storing jobs – were studied here to develop efficient labor complements and methods of operation.

Based on variations observed in a preliminary survey of 30 fluid milk plants, a sample of eight plants was selected in which gross and detailed time studies were made.

Labor productivities for bottling processes and jobs in the processes were measured and reasons for differences in productivities were sorted out. Model bottling lines were synthesized from standard times

and were used as a basis for evaluating existing bottling processes.

Factors contributing to efficient bottling processes included:

1. Balancing the size and work load of the labor complement. Three men were used on one storing job, for example, when two men could have accomplished the same work.

2. A high proportion of operating time. Labor productivity in one plant with 43 percent operating time was only 20.0 bottles per man minute, whereas 31.1 bottles were filled per man minute in a plant with 57.7 percent operating time.

3. Combining jobs. Labor productivity of the washing and loading jobs was increased 100 percent when these two jobs were combined.

4. Integration of the loading job with the receiving of empty cases. This lowered loading time since empty bottles were conveyed directly to the bottle washer.

5. Moving cases, casing-in in unit loads.

6. Eliminating inspection of bottles at the casing table. This increased by 24 quarts per minute the rate of casing-in.

7. Convenient location of tools and controls. Locating the hook used to drag cases in an inconvenient place reduced by 16 cases per minute the quantity moved.

8. Proper illumination. Three more cases of empty bottles could be loaded and inspected per minute where improved illumination was provided.

9. Use of an accumulating table on the bottle washer. This increased the number of bottles fed from 154 to 220 per minute.

10. Adequate maintenance of equipment.

11. Give the picker full control over the flow of cases at the casing table.

Comparison of model bottling lines with existing bottling processes showed existing processes to be relatively inefficient. Labor costs could be reduced approximately $1.50 per 1,000 bottles in some plants. Management can increase the effective use of labor by using model bottling lines as guides and making the necessary adjustments to secure higher labor productivities.

The casing job was normally the limiting factor in the bottling process. The casing-in operation requires the longest standard times of all the operations in the process and elements in this operation cannot be combined with other jobs or operations.

The manual method of casing-in should be used when the pace of the casing-in operation is less than 94 bottles per minute. A semi-mechanical method of casing-in should be used when the pace of the casing-in operation required is greater than 94 bottles per minute. A mechanical casing-in machine may be used for speeds greater than 120 bottles per minute.

It was recognized that the nature of competition may prohibit improvement in labor productivity in bottling fluid milk. Imperfections exist in the marketing of fluid milk and the possibility of increasing efficiency may be related to these imperfections. Research to consider the impact of imperfections in the marketing system appears to be desirable.

121 pages. $1.51. MicA54-1313

A STUDY OF THE EFFECTS OF SOIL MOISTURE UPON PLANT GROWTH AND PHOSPHORUS UPTAKE

(Publication No. 8059)

Gerald Gordon Williams, Ph. D.
Purdue University, 1954

Major Professor: G. O. Mott

This study was designed to resolve the question whether soil moisture between the wilting point and field capacity is uniformly available for plant growth or whether as soil moisture decreases within this range it becomes less available for plant growth. The results of past experimental approaches have been interpreted to lend credence to both viewpoints. Based on a formula describing growth as a function of numerous factors, the following hypothesis was established: Growth may not be limited directly by soil moisture as such until the wilting point is approached, but soil moisture above the wilting point is probably influential in causing other "borderline" growth factors (such as phosphorus uptake) to become limiting.

Three experimental approaches were undertaken and methods perfected with which to study the problem. In the first approach, barley seedlings were grown under uniform conditions until they were transplanted into soils with different known moisture contents. These various soil moistures were prepared by mixing powdered ice with soil at 0°F. There was no statistically significant difference in plant elongation over the available soil moisture range until the wilting point was approached. Throughout this range the moisture content of the barley seedlings was quite constant.

In the second approach to the problem, sunflower plants were grown in pots in the greenhouse. The effect of soil moisture upon growth was determined by studying the rate of geotropic curvature of these plants when grown at different soil moistures. Soil moisture had no effect on the lateral transport of auxin or on growth as reflected by the geotropic response until the wilting point was approached.

In the third approach phosphorus uptake by plants as affected by soil moisture was studied. Barley seedlings were transplanted into soils containing P^{32} and at different known soil moistures prepared by the powdered ice method. Fertilizer phosphorus uptake was found to be a straight line function of soil moisture above the wilting point.

From the evidence obtained it may be concluded that, under the conditions of these experiments, growth is not affected by soil moisture as such until the wilting point is approached. The possibility that soil moisture may affect growth by causing some other factor, such as phosphorus uptake, to become limiting may also be inferred from this study.

In the light of these conclusions it seems possible to reconcile some previous interpretations of soil moisture effects. Many of the workers who showed an increase in growth with increasing soil moisture may have been measuring the effect of ion uptake rather than the effect of soil moisture per se.

107 pages. $1.34. MicA54-1314

PUBLIC LAND POLICY FOR ALBERTA

(Publication No. 8148)

V. Alfred Wood, Ph. D.
University of Minnesota, 1954

Over fifty-seven per cent of the land area of Alberta is still public land under the control of the Department of Lands and Forests.

The disposition of the agricultural lands into economic farm units capable of giving the occupant a reasonable level of living, or which will help to establish economic farm units, is the basic objective of a public land policy of Alberta. To attain this objective it is necessary to first, classify the public lands according to their best use based on the knowledge available; second, to adopt the type of tenure that is most suitable in assisting the farmer and the government in establishing economic farm units and in protecting their respective interests in the land; third, the government should assist the farmer by education, inspection and district agriculturist service, making credit available and by correlating all agricultural policies in such a manner as to assist the farmer in establishing an economic farm unit.

A review of the land policies of the past for Alberta and Western Canada show that fur trading was the primary objective of the Hudson's Bay Company's administration from 1670 to 1870. The dominion government's land policy from 1870 to 1930 was based on the political objective of consolidating the western territory with the rest of Canada and the economic objective to settle the western territory which would increase the agricultural production and help to provide a market for the eastern manufacturer.

The political and economic objectives of the dominion government left the province, in 1930, with the task of readjusting the land settlement to proper land use.

The realization of this problem has forced the provincial administration during the past few years to realize the necessity of having a policy based on proper land use rather than a policy based on political or economic objectives which are not correlated to proper land use.

The public land resources of Alberta consist mainly of the occupied grazing lands of southeastern and southwestern Alberta and the unoccupied grey wooded soils in the northern sections of the province.

In regard to climate and soils, lack of moisture, danger of frost, and for the grey wooded soils lack of fertility, are the main limiting factors to successful crop production.

Of the 159,232,000 acres of land in Alberta over ninety million acres are under the administration of the Department of Lands and Forests. Of this area only nine million acres are now occupied. Of the area of unoccupied land it is estimated there are about twenty-one million acres of land reasonably accessible under present conditions that are suitable for settlement.

After discussing the basic principles for developing and implementing a land policy each soil zone of the province was discussed to determine the problems existing and changes in land policy required. Specific recommendations were made for each soil zone in order that the land policy in effect would be in harmony with the proposed land policy objectives.

214 pages. $2.68. MicA54-1315

AGRICULTURE, ANIMAL CULTURE

SOME IMMUNOLOGICAL STUDIES ON HOG CHOLERA

(Publication No. 8045)

Russell Kay Jones, Ph. D.
Purdue University, 1954

Major Professor: L. P. Doyle

Investigations were made to determine the effect of the inoculation of hog cholera susceptible pigs with a commercially available live modified hog cholera virus, ROVAC.* Information was gathered concerning the effect of the modified virus when inoculated into supposedly normal pigs, and into pigs in which other infections were established at definite time intervals in relation to the inoculation of the virus. Concurrent infections with the agent of transmissible gastro-enteritis (TGE) or Salmonella cholerasuis and ROVAC were established in some pigs. A total of 229 initially cholera susceptible pigs were used in the investigations.

It was found that the inoculation of ROVAC into supposedly normal pigs was followed by a trend toward depressed rate of growth during the first several subsequent weeks as compared with uninoculated controls. The inoculation of ROVAC into supposedly healthy pigs was followed by a trend toward reduced numbers of circulating white blood cells. A few ROVAC pigs inoculated were found to have total white blood cell counts less than 10,000 per cmm.

Material having the antigenic property, but apparently not the virulence, of standard hog cholera virus was demonstrated in the tissues of pigs which sickened or died following ROVAC inoculation. Such material was demonstrated in pigs found to have lesions of hog cholera when examined at necropsy as late as 31 days after the inoculation of ROVAC.

It was found that the establishment of concurrent infection of pigs with TGE and ROVAC resulted, in most cases, in a greater depression of the rate of growth than infection with either of the agents alone. Such depression was more marked in pigs of relatively light weight (20-30 pounds) than in heavier pigs (in excess of 40 pounds). In such light pigs some deaths occurred within 3 weeks after the establishment of concurrent infection, although no deaths occurred during the same period of time in singly infected pigs.

Two experiments in which concurrent infections with ROVAC and Salmonella cholerasuis were established in pigs yielded results which were not in

total agreement. In one trial no particular deleterious effect of the concurrent infections was noted, while in the second trial marked reduction in rate of gain and heavy death loss resulted. The use of a different strain of Salmonella cholerasuis and the addition of mucin to the culture used for the second exposure, as compared with the first, may have accounted for the increased virulence of the bacterium in the second trial. In this latter trial pigs infected concurrently died sooner than those infected with Salmonella cholerasuis alone.

No evidence was found that concurrent infections with ROVAC and TGE of Salmonella cholerasuis affected the immune response to ROVAC in surviving pigs, as measured on a survive-or-die basis, when challenged with standard hog cholera virus.

97 pages. $1.21. MicA54-1316

*Lederle Laboratories Division, American Cyanamid Company, New York, New York.

PASTURE INVESTIGATIONS WITH SPECIAL REFERENCE TO THE FEEDING BEHAVIOR OF THE DAIRY COW

(Publication No. 8127)

Hugh Gibson Livingston, Ph. D.
University of Minnesota, 1954

The Review has three sections: Pasture Aspects; Animal Aspects; and the Pasture-Animal Complex. Information concerning the grazing habits of the cow is critically presented.

Experimentally, comparisons have been made for two seasons as follows: Free-range grazing versus daily rotational grazing systems; Daily rotational grazing versus dry-lot feeding of dairy cows using chopped green forage as the sole fresh pasture component of the ration.

Experiment 1. Free-range versus daily rotational grazing.

Ten experimental animals were used made up of three sets of identical twins split between the two management systems, and four high-yielding adult cows. Two 5-acre alfalfa/bromegrass pastures were used. An abnormally good growing season apparently favored the free-range pasture, thus the results are only applicable under the prevailing weather conditions.

Hay was available ad libitum as a precaution against bloating, but this, plus a mineral supplement, was the only extra feed given.

1. No differences were observed in total animal production between the systems. Observation and experience suggest that the daily rotational system, with its pasture-sparing effect, would show up better than the free-range system under poorer growing conditions.

2. Considering total T.D.N., production per pasture, the daily rotational system, which allows hay or silage cuts to be taken, is better than the free-range system, which makes no provision for utilizing surplus pasture.

3. Milk yields declined seriously over the season regardless of the system. This may be due to using only one pasture with all its varying nutritive levels.

4. Selective grazing was practiced by the cows on both systems the free-range group being especially marked.

5. Four behavior studies were conducted on the experimental animals and interesting findings obtained.

Experiment 2. Daily rotational versus soilage.

In this experiment the 70 cows were fed normally regarding their concentrate rations and hay. The only difference was the manner in which the groups received their fresh pasture.

1. The soilage group produced more milk per pasture and over the season than the daily rotational group. This difference is not significant but it is consistently in favor of the soilage group. This difference, however, does not justify a change over to the soilage method of pasture management.

2. The increased milk production may have been due to the soilage cows eating more food per day than is normally expected of cows.

3. The soilage system is a much more efficient means of utilizing heavy crops for forage than even daily rotational grazing.

4. Soiling saves pasture that would otherwise be wasted by grazing animals. It was found, however, that the areas chopped for soilage took longer to grow back than the grazed pasture areas.

5. Grazing required 51 acres of pasture, while soilage required 31 acres for the season.

6. It was better to cut soilage at the early hay stage. Cut at the best grazing stage gave too little density.

7. Inclement weather is very upsetting to the soilage system and an emergency pasture is essential.

8. The animals liked the chopped soilage save when it heated. Freshly cut it could heat in a few hours. Feed-box design influences this.

9. The management aspects are discussed in detail with various suggestions for future experimental work on this very interesting pasture system.

221 pages. $2.76. MicA54-1317

A STUDY OF SOME FACTORS AFFECTING PROTEIN UTILIZATION WITH PARTICULAR REFERENCE TO THE PROTEIN-DEPLETED RAT

(Publication No. 7858)

Venkata Chalam Metta, Ph. D.
University of Illinois, 1954

With the purpose of ascertaining the similarities and dissimilarities of the process of growth and nutritional rehabilitation as they relate to protein

utilization in low-fat and high-fat diets, growing rats and protein-depleted mature rats were fed iso-caloric (gross energy) amounts of low-fat and high-fat diets and the biological values were determined according to the Illinois Method. Protein depletion was induced both according to Paul Cannon's long-time method or Frost and Sandy's short-time method. The two levels of fat that were studied were about 5 per cent and 35 per cent, respectively.

High-fat is found to have no significantly favorable effect on the apparent digestibility of casein either for the growing rat or for the protein-depleted rat.

The biological values of casein are not significantly affected by the fat content of the diet both for the growing rat and the severely protein-depleted rat; but casein, particularly in low-fat diet, is better utilized ($P < 0.01$) by the growing rat than by the severely depleted rat, indicating a difference in the amino acid requirement for repletion of depleted tissue.

The excretion of metabolic fecal nitrogen per gram of dry matter consumed is greater on the high-fat diet both for the growing rat ($0.05 < P < 0.1$) and for the depleted rat ($P < 0.001$), but the endogenous urinary nitrogen is not favorably affected by the high-fat diet for the growing rat and the severely depleted rat except for the moderately depleted rat.

A study of the effects of equal dry matter intake of the low-fat low-nitrogen diet and the high-fat low-nitrogen diet reveals no significant difference on metabolic fecal or endogenous urinary nitrogen excretion both in the growing rat and the depleted rat.

A study of the effects of increasing dietary fat levels from zero to 68 per cent and feeding severely protein-depleted adult rats on an iso-caloric basis, reveals that the metabolic fecal nitrogen per gram of dry matter consumed increases significantly ($P < 0.001$) as the fat level is increased beyond a 5 per cent level. This effect is not, however, due to the increasing levels of dietary fat but due to a concomitant reduction in the dry matter intake. The relationship between dry matter intake (irrespective of the nature of the dry matter) and the metabolic fecal nitrogen per gram of dry matter consumed is inverse and roughly linear beyond a 5 per cent level of dietary fat.

With the purpose of ascertaining the applicability of the Atwater energy conversion factors to rat nutrition, three balanced diets differing widely in their proportions of calorigenic nutrients (casein, starch, and a mixture of fats) were fed to 12 adult rats according to a 3 x 3 latin square design, and the metabolizable energy for each diet for each rat was determined in 34 metabolism periods. The metabolizable energy values were then factorized into values for the three energy yielding nutrients, using a multiple regression equation of the type: $ME = cC + sS + fF$, in which ME is the determined metabolizable energy for the diet, C, S and F the weights consumed of casein, starch and fat, respectively, and c, s and f the constants to be determined from the 34 sets of data by the method of least squares, representing the metabolizable energy per gram of the respective nutrients. The metabolizable energy values thus obtained with their standard errors are as follows:

Casein	4.673 ± 0.089 calories
Starch	3.962 ± 0.016 "
Mixture of fats	8.770 ± 0.065 "

Analyses of the urine of rats on a very high-protein diet for energy and total nitrogen yielded 6.29 calories per gram of urinary nitrogen. This value was used in correcting urinary energy to nitrogen equilibrium. 89 pages. $1.11. MicA54-1318

THE EFFECT OF AN ANTIBIOTIC AND A MIXTURE OF ANTIBIOTICS UPON THE QUALITY, PHYSICAL AND CHEMICAL COMPOSITION OF PORK CARCASSES AND CUTS

(Publication No. 7883)

Richard Ferman Wheeler, Ph. D.
University of Illinois, 1954

The feeding of antibiotics to growing-fattening swine has received considerable attention during the past few years. Their effect upon the quality, physical and chemical composition of pork carcasses and cuts has not been clearly demonstrated, even though several investigators have studied certain aspects of this problem. The effect of antibiotics upon certain quality characteristics such as color and intramuscular fat has not been reported.

Duroc Jersey hogs were self-fed a fortified corn-soybean oil meal ration from an initial weight of about 41 pounds to a slaughter weight of approximately 200 pounds. Eight hogs were fed the basal ration; eight were fed the basal ration plus 16 mg. of terramycin per pound of ration; and eight were fed the basal ration plus 4 mg. each of terramycin, bacitracin, penicillin, and streptomycin per pound of ration.

The right half of each carcass was separated into the various cuts and trimmings which were weighed. The cuts and trimmings were mechanically separated into lean, fat, skin, and bone and the individual components of each were weighed.

A strip of fat was taken from over the lumbar region of each left side for the determination of iodine number and refractive index. Slices of ham, loin, boston butt, belly lean, and belly fat were taken from the left sides for color measurements with a General Electric recording spectrophotometer.

The lean and the fat of the individual primal cuts and trimmings were analyzed for dry matter, ether extract, and protein (NX6.25). For the purpose of the chemical determinations, all cuts other than the primal ones were classed as trimmings.

The average daily gains of the antibiotic-fed hogs were appreciably greater than those of the check animals for the first nine weeks. During the subsequent period, when fed to a weight of 200 pounds the daily gains of the check hogs were appreciably greater than those of the antibiotic-fed hogs. When the entire growing-fattening period was considered, there

were no differences in the average daily gains due to the addition of antibiotics to the rations.

There were no differences in the dressing percentages, firmness, color of the lean or the fat, and average back fat thickness due to the addition of antibiotics to the rations. However, the carcasses from the hogs which were fed the mixture of antibiotics had appreciably thicker fat over the hams and somewhat thicker back fat over the first thoracic vertebra. Consequently they graded somewhat lower than the check carcasses.

The total primal and lean cuts represented a slightly higher percentage of the carcasses from the hogs fed in the check lot than of those from the hogs fed the mixture of antibiotics. However, there were no differences in the percentages of the individual primal or lean cuts due to the addition of antibiotics to the rations. The percentage of fat back from the carcasses of the hogs which were fed the mixture of antibiotics were slightly greater than that of the check animals.

There were no differences in the percentages of separable fat, separable lean, total ether extract, ether extract of the lean, or protein of the sides due to the addition of antibiotics to the rations. The carcasses from the terramycin-fed hogs contained slightly more dry matter than those from the check animals.

In general, there was little or no effect of an antibiotic or a mixture of antibiotics upon the quality, physical and chemical composition of pork carcasses and cuts. 130 pages. $1.63. MicA54-1320

AGRICULTURE, PLANT CULTURE

INHERITANCE OF REACTION TO LOOSE SMUT AND TO STEM RUST IN BARLEY

(Publication No. 8109)

John Edwin Andrews, Ph. D.
University of Minnesota, 1954

Inheritance of reaction to two collections of Ustilago nuda (Jens.) Rostr., was studied in crosses among the varieties Anoidium, Valentine, and Montcalm. Reactions of a series of tester varieties indicated distinct differences in virulence between the two collections. The parent varieties Anoidium and Valentine were resistant, with 3.9 and 2.7 per cent infection respectively, and Montcalm susceptible with 61.7 per cent infection to one collection which was designated as Vr. Anoidium was resistant with 0 infection and both Valentine and Montcalm were susceptible, with 60.9 and 60.8 per cent infection respectively, to the second collection which was designated as Vs.

The genetical analysis of data from the F_1, F_2, F_3, and backcross progenies of crosses with Valentine indicated that its resistance to collection Vr of U. nuda was controlled by a single dominant gene. This is probably the same as the dominant gene for resistance previously reported in the variety Trebi, which is one of the parents of Valentine. This gene has been assigned the symbol Un.

The F_2 and F_3 data from the crosses Montcalm x Anoidium and Anoidium x Valentine grown in the field, and data from F_3 lines of Anoidium x Montcalm grown in the greenhouse indicated that the resistance of Anoidium to collection Vr of U. nuda was conditioned by a single recessive gene. This recessive gene was found to be independent of the dominant gene in Valentine for resistance to the same race. Since a recessive gene conditioning high resistance to loose smut in barley has not been reported previously in the literature, this is probably a new gene and is provisionally designated as un7.

In studies of inheritance of reaction to collection Vs of U. nuda, data from the F_1, F_2, and F_3 of Anoidium x Valentine and backcross progenies of (Anoidium x Valentine) x Valentine grown in the field, and from F_3 lines of Anoidium x Montcalm studied in the greenhouse indicated a single dominant gene for resistance. However, the distribution in infection classes of F_3 lines of Montcalm x Anoidium and of backcross progenies of Montcalm x (Anoidium x Montcalm) grown in the field were skewed farther toward the susceptible side than expected on the basis of a single dominant gene for resistance. This could have been due to selective mortality against resistance genotypes in the field.

Inheritance of reaction to stem rust Puccinia graminis tritici Eriks. and Henn., was studied in the field and at both high (80°-85°F) and low (65°-70°F) temperatures in the greenhouse. Race 56 was used in the field study and race 15B in the greenhouse. In the field, reactions of F_2 plants and F_3 lines of Montcalm x Valentine and Anoidium x Valentine, and of backcross lines of Montcalm x (Montcalm x Valentine) all indicated that the resistance of Valentine was conditioned by a single dominant gene. Seedling reactions to race 15B of F_3 lines of Anoidium x Valentine grown at high temperature in the greenhouse also indicated a single dominant factor for resistance. Although the possibility of two closely linked genes was not ruled out, seedling reaction to race 15B and mature plant reaction to race 56 both appeared to be controlled by the same factor pair.

A greenhouse temperature of 80°-85°F was found satisfactory and one of 65°-70°F unsatisfactory for differentiating resistant and susceptible material.

Genes for resistance to stem rust and to collection Vr of U. nuda in the variety Valentine were found to be linked. The combined recombination value obtained from backcross and F_2 data was 9.19 ± 1.78 per cent.

No association was found between genes for awn barbing or rachilla hair length and the disease reactions studied. 64 pages. $1.00. MicA54-1321

AN INVESTIGATION ON THE ENVIRONMENTAL FACTORS AFFECTING THE DEVELOPMENT OF PUCCINIA ASPARAGI DC.

(Publication No. 7828)

Louis Beraha, Ph. D.
University of Illinois, 1954

INTRODUCTION

The investigations reported deal with factors favoring development and survival of the rust fungus Puccinia asparagi DC. the incitant of asparagus rust.

CONCLUSIONS

Basidiospores of P. asparagi could infect Asparagus scaber, A. acutifolius and A. maritimus and all commercial varieties of A. officinalis tested, producing in succession pycnia, aecia, uredia and telia. No infection resulted on A. asparagoides, A. sprengeri, A. scandens var deflexus and A. plumosus. All susceptible varieties and species produced a 4 type or very susceptible rust reaction (cereal rust scale), when inoculated with urediospores from widely separated sources in Illinois. Collections of these urediospores infected 2-3 month old plants of Allium cepa, A. fistulosum, A. ascalonicum, A. shoenoprasum and progeny of A. cepa-fistulosum and A. ascalonicum-fistulosum. The infection resembled a O;-1 type infection on all susceptible plants. No infection was obtained on A. porrum, A. sativum or A. ameloprasum.

Teliospores from plants in the greenhouse or field, did not require the interposition of a period of sub-freezing temperatures before they germinated, since they could germinate and initiate the production of pycnia and aecia soon after their formation. Attempts to increase the percentage of germination of teliospores were unsuccessful using either chemical or physical stimuli.

Evidence that the fungus is heterothallic, is presented for the first time.

Urediospores may germinate from 1° to 30° C. with the optimum of immature spores at 10° C. and of mature spores at 10°-15° C. At temperatures above the optimum, germination is completed in 2 hours, at the optimum temperatures, after 3-4 hours, at lower temperatures, a proportionally longer time is required. Immature spores germinate slowly and poorly especially at higher temperatures.

The rate and final growth of germ tubes is greatest at 15° and 20° C. and is less so at 10° and 27° C.

Newly formed urediospores on stems in the field remained viable overwinter and at 4 -5° C. at moderate relative humidity in storage. Both high temperatures and relative humidity were unfavorable for the maintenance of viability of detached urediospores and teliospores.

The gametophytic and sporophytic mycelium resulting from basidiospore inoculations and subsequent diploidization, developed well at constant temperatures of from 20°-29°C. At 10° and 15° C. the incubation stage lengthened 2-3 times that at higher temperatures. Similarly, uredia appeared rapidly at from 25°-29° C. and their appearance was delayed proportionally at lower temperatures. Light was of secondary importance given conditions otherwise favorable.

When plants were continuously wet at temperatures from 15°-28° C., infection took place within 3 hours, at 10° C. within 4-1/2 hours, while at 2° C. no infection was apparent within 12 hours and only a trace after 24 hours. The optimum temperatures for ingress by the fungus were 10° to 20° C. At these temperatures, the maximum intensity of infection was obtained within 6-9 hours of continuous wetting. At both higher and lower temperatures, a longer period of continuous wetting was required to obtain the maximum infection.

While low temperatures retarded the development of mycelium within the suscept, uredia appeared promptly upon return to suitably higher temperatures. A predisposition to a temperature of 25° C. of 2, 4, and 5 days did not cause a lengthening of the normal period of incubation when plants were subsequently transferred to 20°, 15° and 10° C. respectively.

Young actively growing succulent shoots or regions of a plant were more susceptible than mature dark green portions.

The available evidence does not support the view that physiological races of the fungus have accounted for the loss of supposed resistance in the Washington strains. 94 pages. $1.18. MicA54-1322

NATURAL AVAILABILITY OF OAK WILT INOCULA

(Publication No. 7838)

Elroy Arvel Curl, Ph. D.
University of Illinois, 1954

Need for information that would be useful in explaining the spread of oak wilt prompted an intensive study of the availability of oak wilt inocula. This study was made in 5 major wilt areas in Illinois and covered the 10-month period from October, 1952, through July, 1953.

A total of 649 typical mycelial mats were found on 31 selected trees, some of these occurring in each of the 10 months. Mat development was greatest during April, May, and June. The fruiting mats occurred readily on both standing and felled trees.

Padless mats formed on 17 of 213 pieces of bark that were taken from diseased oaks and placed on the forest floor. This growth occurred only during March and April. No macroscopic growth formed on any of 128 wood pieces that were treated in the same manner.

The development of macroscopic mycelial growth of Endoconidiophora fagacearum was readily induced during March, April, and May simply by making cuts through the bark of trees that were nearing the mat-producing stage. This suggests a strong air relationship in mat initiation.

The rate of development and decline of mycelial mats from the immature stage to a deteriorated

condition varied according to the season in which the mats appeared. Mats that appeared during the spring and summer deteriorated rapidly as compared to the slow decline of mats that formed during the autumn and winter.

Field observations and laboratory feeding tests showed that insects, particularly Nitidulidae, are effective destroyers of the fungus mats. Other destructive agents are adverse weather, bacteria and other microorganisms, and squirrels.

Three naturally occurring inocula are recognized, conidia, ascospores, and mycelial pad cells. Spore counts from samples indicated that the highest concentration of conidia was on mature mats in December, but best germination was obtained with conidia collected from immature mats in April.

The significance of mat size in addition to numbers of mats in accounting for the concentration of conidia in an oak wilt area was demonstrated from sample data. A mat that measured 24 X 10 cm. was estimated to have 1,657,894,700 conidia.

Twenty-three percent of 393 mats (which were presumed to be old enough to have perithecia) contained perithecia. Mats with perithecia were found in all months except July, and the highest average number of perithecia occurred on aging mats in May. Best germination was obtained with ascospores collected from aging mats in April.

Mass transfers of cells from 423 mycelial pads to potato dextrose agar showed that cells from immature, mature and aging mats were viable, 82 percent of the pads from immature mats giving positive cultures.

Results of laboratory tests showed that longevity of conidia of E. fagacearum is favored by low temperatures and a dry atmosphere. Conidia on artificially-grown mats were still viable after 250 days over calcium chloride at 0°, 12°, and 16° C but not at higher temperatures. At 100 percent humidity conidia remained viable for 102 days at 0° and 12°.

Tests in vitro also showed that perithecium formation is favored by temperatures of 16° and 22°. Ascospores germinated best at 25° and 28° on both 2 percent water agar and 2 percent dextrose agar. The highest germination of conidia on 2 percent water agar also occurred at 25° and 28°. Mycelial pad cells germinated readily on water agar at 15°, 22° and 28° and produced endoconidia abundantly.

95 pages. $1.19. MicA54-1323

THE FUSARIUM DISEASE OF GLADIOLUS

(Publication No. 7843)

Junius Leonard Forsberg, Ph. D.
University of Illinois, 1954

Three forms of the Fusarium disease of gladiolus, known as the vascular, brown rot and basal dry rot forms, have been described by other workers. The Fusaria which cause these disease forms have been assigned various specific names, with the result that the exact relation of the different symptom types and their causal agents has been in a state of confusion.

The purpose of this investigation was to clarify the confusion by determining if strains of Fusarium producing different symptoms could be fitted into well defined groups on the basis of their pathogenicity and physiological characters.

From several hundred isolates of Fusarium that had been cultured from diseased gladiolus corms, 40 isolates were selected for comparison in pathogenicity tests and physiological studies. Comparisons of isolates from the three disease forms were made by means of their reactions to temperature, reactions to aniline dyes, reactions to copper salts, reactions to mercuric chloride, color reactions on steamed rice, growth types on differential media, pH changes produced in liquid media, spore measurements, and tendency to reproduce the same or different forms in inoculated plants and corms.

The isolates varied a great deal in their reactions in these tests but no definite pattern for association of variables could be determined; the variations seemed to occur independently. The isolates did not fall into well defined groups; the isolates from the three disease forms could not be distinguished by any of the tests used. The pathogenicity tests showed that a single isolate is capable of producing more than one form of the disease.

The evidence obtained in these studies shows that strains of the gladiolus Fusarium are extremely variable and some of them apparently are quite unstable. It is proposed that all forms of the gladiolus Fusarium be included under the name Fusarium oxysporum f. gladioli (Massey) Snyder and Hansen.

102 pages. $1.28. MicA54-1324

THE REPRODUCTIVE PHYSIOLOGY OF PLANTS WITH SPECIAL REFERENCE TO PEPPERMINT

(Publication No. 8048)

Ruble George Langston, Ph. D.
Purdue University, 1954

Major Professor: A. C. Leopold

The photoperiodic responses of peppermint (Mentha piperita, L.) were studied. It was shown to be a long day plant with a critical daylength between 16 and 18 hours. Light intensity over a broad range had little effect on photoperiodic response while it was an important factor in floral development after floral induction. Peppermint leaves showed an increased number of oil glands per unit area on the lower epidermis with increasing daylengths. Under the conditions tested no measurable oil quantities could be obtained when the plants were grown in daylengths of 14 hours or less.

The effects of various degrees of floral induction on some B-vitamins were studied in Wintex barley. Biotin, niacin and pantothenic acid decreased with floral induction while riboflavin content remained constant. Night interruption studies indicated that

biotin and pantothenic acid reductions were associated with the photoinductive process while niacin changes might be more readily ascribed to the light ration. The data suggest that biotin is converted into a more insoluble complex in the photoinductive process while pantothenic acid is apparently caused to be translocated or destroyed.

The relationships between CO_2 fixation in the dark and photoperiodic induction were studied in the short-day species Xanthium and Biloxi soybean and the long-day plant, Wintex barley. Floral inhibition occurred when soybean and Xanthium were exposed to long dark periods which were maintained free of carbon dioxide. Similar conditions only slightly inhibited barley. Carbon dioxide fixation was promoted by floral induction in both the short and long-day species. Fixation patterns were different in long and short-day species. Night interruption treatments showed opposite effects on $C^{14}O_2$ fixation in the long and short-day species. Night interruption treatments promoted a loss of $C^{14}O_2$ fixed in the preceding part of the dark period and lowered the rate of $C^{14}O_2$ fixation in the following part of the dark period in the short-day plants.

Studies were conducted on the relationship between pantothenic acid and acetic utilization in tomato fruit-set. The experiments reported indicate that acetic acid can not be effectively utilized as a nutrient for fruit-set by the excised flowers tested unless pantothenic acid is supplied as well.

The effect of foliar applications of sucrose on rooting and transplantability of peppermint cuttings and transplants were studied. A 5% sucrose solution appeared to produce maximum response when based on primary, secondary or total roots and total dry weight of roots produced. Eight percent sucrose produced a maximum response when root length was used as the criterion. The optimal interval between spraying and transplanting, based on the above criteria, varied between 4 and 5 days. Mortality was reduced with 5 and 8% sucrose applications when the plants were transplanted 5 or 7 days after treating.

The effects of foliar applications of various concentrations of maleic hydrazide on the growth and development of peppermint were studied during two growing seasons. Maleic hydrazide reduced the formation of primary lateral branches and increased the number of secondary lateral branches. Flower development was greatly delayed in approximate proportion to the concentration of maleic hydrazide applied. Insignificant increases in oil content were observed with applications of 300, 1500, and 3000 ppm of maleic hydrazide with the largest increase of 11 pounds per acre occurring in those plots receiving 1500 ppm. 105 pages. $1.31. MicA54-1325

ASSOCIATION TESTS BETWEEN CHROMOSOMAL INTERCHANGES IN MAIZE AND TENDER PERICARP IN SWEET CORN

(Publication No. 8129)

Aly Hamed Mohamed, Ph. D.
University of Minnesota, 1954

Studies were conducted to locate, by the use of chromosomal interchanges, the genetic factors which differentiate tender from tough pericarp at the eating stage. The fourteen interchange lines and dent corn inbred Wis23 were used as the tough pericarp lines and sweet corn inbred S4 as the tender pericarp line. Notes were taken also on silking date, pollen shedding date and tillering on the same plants.

Crosses between S4 and the tough pericarp interchange lines were made and the semisterile F_1's were backcrossed to the tender pericarp S4 and to the tough pericarp Wis23 line. Based on the average readings in F_1's tough pericarp appeared to be incompletely dominant. Early silking date showed practically complete dominance over late silking, early pollen shedding was partially dominant over late pollen shedding and presence of tillers was dominant over absence of tillers.

In the backcrosses of S4 x (interchanges x S4) significant association was obtained between pericarp tenderness and certain interchanges. For all these associations the average puncture test reading for the normal plants was higher than for the semisterile plants. This is in the opposite direction from that expected from the way the crosses were made, i.e., since the normal non-interchange sweet corn parent was the tender pericarp line, the normal plants would be expected to have the lower readings. If the associations indicated by the X^2 analysis do indicate genes differentiating tender from tough pericarp then there is at least one gene pair in each of three chromosome arms: 4S, 6L, 7L and at least one more indicated by the associations with $T1^{S}\text{-}3^{L}$ and $T1^{S}\text{-}3^{L}$. In the backcrosses of S4 x (interchanges x S4) the association tests indicated at least two genes for date of silking: one in 4S and at least one more indicated by the association with T6-9d.

From the association tests with date of pollen shedding in the same backcrosses, at least three genes are indicated: one in 4S, one in 10L and at least one indicated by the association with T6-9d. Since one of these is different from that for silking date, the data suggest that not all the genes controlling the two characters are the same. It is by no means conclusive evidence.

From the same above backcrosses, at least three genes were indicated for tillering: one in 4S, one in 7L and the third in 10L.

In the progeny of (interchanges x S4) for pericarp tenderness backcrossed to Wis23; the association tests indicated at least one gene in 4S, one in 6L, one in 3S, and at least one more as indicated by the associations with $T5^{L}\text{-}7^{S}$ and $T5^{L}\text{-}7^{L}$.

For silking date, at least one gene in 10S, probably one in 6S and one in 1L were indicated.

For pollen shedding date, at least one gene in 2S and another in 7L were indicated.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

For tillering, at least one gene in 3L, one in 2S, one in 10S and one in 7S were indicated.

Tests showed significant association between tenderness and sugary and certain of the other characters in backcrosses involving certain of the interchanges but not others. This indicates the interchange lines were not homogeneous for all the characters.

The associations by which the loci of genes for tenderness were determined do not necessarily mean that each of the interchange lines differed from S4 by all of these genes. The interpretation to be placed on the fact that the associations with tenderness were not in the direction expected requires further study. 139 pages. $1.74. MicA54-1326

SOME STUDIES ON THE EFFECTS OF THE INCORPORATION OF CERTAIN GROWTH STIMULANTS IN PELLETED SEED ON GERMINATION AND DEVELOPMENT OF THE SEEDLINGS

(Publication No. 8071)

Donald Wilson Newsom, Ph. D.
Michigan State College, 1952

Data on the effects of pelleting and the incorporation of fungicides, fertilizers and growth stimulants on germination and growth and development of the seedlings were taken.

Seed of sweet corn, cabbage, lettuce and tomato were pelleted. Arasan, cupric oxide, iron chlorophyll, bone char, superphosphate, calcium salt of keto succinic acid, sulfuric acid, potassium nitrate, and dried blood were incorporated singly and in various combinations in the pellets.

The pelleting process consisted of building up the seed to the desired size with a coating material composed of 70 per cent minco clay and 30 per cent cellite. The coating was made to adhere to the seed by spraying with an 8 per cent solution of methyl cellulose having a viscosity rating of 15 centipoises while the seeds were rotated at 45 revolutions per minute in a rolled copper drum. The fungicides, fertilizers, and growth stimulants were added to the seed in the process of pelleting.

Statistical analyses of the data indicated that pelleting did not affect germination, seedling development, nitrate nitrogen, soluble phosphorus or potassium oxide content in the plants, earliness or yield.

Since pelleting had no adverse effect on germination, it will be of considerable value to vegetable growers in that it will allow for precision planting of small seeded crops and eliminate excessive hand thinning. On the basis of this work it would appear to be an economically sound practice from the standpoint of precision planting.

54 pages. $1.00. MicA54-1327

INHERITANCE OF REACTION TO RACE 15B AND SOME OTHER RACES OF STEM RUST OF WHEAT

(Publication No. 8133)

Abdel-Aziz Mostafa Omar, Ph. D.
University of Minnesota, 1954

Stem rust of wheat Puccinia graminis tritici Eriks. and Henn. is one of the most destructive diseases in the spring wheat area. The epidemic of 1950 and 1953 was caused primarily by race 15B, the most virulent race ever found in North America. The commercially grown wheat varieties are all susceptible to this race. The present studies were undertaken to determine the mode of inheritance of field reaction to a collection of races as well as seedling reaction to race 15B at the high temperatures in some local and introduced varieties of spring wheat. Certain other characters were studied also, including awnedness, waxiness, earliness, and dwarfness.

The studies were made on 24 crosses involving the following 12 spring wheat varieties as parents; Egypt. x Frontana selection, Egypt. N.A. 95, Egypt. N.A. 101, Kenya 58, Kenya 117A, Kentana, Marquis selection, Timstein x Henry selection, Lee, Lerma, Mida, and Thatcher.

The field resistance to a collection of races of stem rust appeared to be controlled by two complementary factors, R and S. The factor R exists in three alleles R, R^1 and r, while the factor S exists in two alleles S and s. The R S combination was resistant, R' S was moderately resistant, Rs or rS was susceptible, R' s or rs was very susceptible.

The seedling reaction to race 15B of stem rust at the high temperature of 80^0- 85^0F, was found to be governed by two separate factors, T and W. The factor T exists in four alleles, T for immune, T^t for resistant, T^2 for moderately resistant, and t for susceptible. The factor W exists in two alleles, W for moderately susceptible, and w for susceptible. The factor T is epistatic to W. The parental varieties were grouped in five classes, immune Tw, resistant T^1w, moderately resistant, T^2w, moderately susceptible tW, and susceptible tw.

Awnedness and waxiness were inherited, each on a monogenic basis. Awnletted B_1 being dominant to fully awned b_1 and non-waxy Wx being dominant to waxy wx.

The inheritance of earliness was explained by assuming four factors, A and B for earliness, C and D for winter habit. The crosses studied included early, medium, and late varieties. The genotypes of these different parents were given as A b C D for the early, A b c d for the medium, and a B c d for the late parents.

Test for association were made between the above characters. There was independent inheritance in most of the crosses. Some crosses showed significant association between certain characters, as between field reaction and awnedness, field reaction and seedling reaction to race 15B, and between earliness and awnedness.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Dwarfness segregated in three crosses on a digenic basis of 13:3. The factor D was given for dwarfness, and N for normals with N epistatic to D. But neither the one nor the two-factor hypothesis explained the segregation for dwarfness in F_1.

Leaf tip necrosis was found to be associated with the seedling resistance to race 15B under high temperature in six parental varieties, Kenya 58, Kenya 117A, Egypt. N.A.95, Egypt. N.A. 101, Kentana, and the Marquis selection. This character appeared also in the progenies of crosses between resistant varieties and susceptible ones.

Prematurely killed plants at the time of harvest were found to be strongly associated with lateness in heading. They were not associated with awnedness and waxiness, except in two crosses. There was an indication of association between number of killed plants and awnedness in one cross, and between number of killed plants and waxiness in the other cross. 127 pages. $1.59. MicA54-1328

WINTER HARDINESS OF BIRDSFOOT TREFOIL STRAINS AND VARIETIES

(Publication No. 8137)

Kenneth Owen Rachie, Ph. D.
University of Minnesota, 1954

The main purpose of this study was to determine the relative winter hardiness of various birdsfoot trefoil strains and varieties. Investigations were conducted on the effect of artificial freezing, date of seeding and the number of clippings on the persistence of birdsfoot trefoil. Additional studies were made comparing the yield and protein content of Ranger alfalfa and Empire birdsfoot trefoil.

Viking, Empire, Cascade, Granger and Italian birdsfoot trefoil varieties and Ranger alfalfa, medium red clover, Ladino clover, and white clover were artificially frozen after various stages of growth in the greenhouse. Variety seedings were also made in the field at Rosemount in 1951 and at the University Farm in 1952. From both greenhouse and field experiments some general observations were made: Ranger alfalfa was the hardiest of all varieties tested. Red clover, white clover, Empire, and Viking birdsfoot trefoil had good cold hardiness but were not as hardy as Ranger. Cascade and Granger were intermediate in cold hardiness. French, Italian, Oregon Narrow Leaf trefoils and Ladino clover were the least winter hardy.

Seedings of Empire trefoil and a mixture of Ranger alfalfa-medium red clover were made on progressively later dates in the fall. Ranger alfalfa and medium red clover were observed to germinate later in the fall and make better winter survival of seedlings than Empire trefoil.

Yields of Empire trefoil and Ranger alfalfa were taken on two cutting treatments. In one treatment the forage was cut twice in the season at the hay stage. In the second treatment the forage was cut four times during the season up to September 1. Alfalfa out-yielded the trefoil in both treatments.

Protein determinations were made on the clipped forage from the two cutting treatments mentioned previously. Empire trefoil was found to have about the same protein content as Ranger alfalfa. The protein content of both varieties was higher when cut earlier than in the hay stage.

63 pages. $1.00. MicA54-1329

SOME ASPECTS OF RESISTANCE TO CUCUMBER VIRUS 1 IN CUCUMBER AND SQUASH

(Publication No. 8198)

Lester William Schaible, Ph. D.
Cornell University, 1954

Chinese Long and Tokyo Long Green react differently to cucumber mosaic virus although both are resistant. Ten to fourteen days after inoculation Chinese Long manifests moderate mottling of leaves but makes a strong recovery as evidenced by symptomless growth. Tokyo Long Green does not manifest as much mottling initially but symptoms progressively become more severe. A major objective of this study was to determine if immunity to CMV could be attained by recombination of the different factors for resistance from the two varieties.

F_5 progenies from the cross Chinese Long x Tokyo Long Green were evaluated for resistance to CMV. The tests included: reactions to different strains of CMV, virus assays of corollas from infected plants by local lesion method on cowpea, grafting by use of infected dodder, and grafting on infected susceptible varieties by use of an approach graft. In all tests except the last the resistant segregates manifested a level of resistance near immunity. Moderate symptoms were visible when segregates were grafted to a susceptible variety but new growth became symptomless after the grafts were severed.

In the F_1 of resistant $(C.L. \times T.L.G.)_{F_5}$ x susceptible the inheritance of resistance to CMV is partially dominant. In the F_2 a small percentage of segregates appears symptomless with a relatively high percentage falling into a moderately resistant or susceptible classification.

Several technical problems relative to a mosaic breeding program were also studied. In a series of 12 trials infected plants of cucumber and tobacco were compared as sources of CMV for inoculating cucumber and squash. Previous workers have reported that cucumber is a poor source of CMV inoculum as evidenced by very low local lesion counts on cowpea in contrast to high counts from the tobacco source. While previous results were confirmed on cowpeas, the cucumber source of CMV consistently produced symptoms on cucumber and squash that were more severe than those produced by the tobacco source. This apparent conflict in results is good evidence that substances in cucumber sap are not inhibitory against CMV itself but have an effect on

cells of certain hosts that render them less susceptible to the virus.

Freezing inoculum of CMV was found to be a good method of storing inoculum for future use. In tests where once, twice, and thrice frozen aliquots were compared with fresh counterparts there was no detectable loss of active virus concentration where inoculum was once and twice frozen but a significant drop was noted in the thrice frozen aliquot as evidenced by local lesion counts on cowpea and systemic symptoms on cucumber.

Dosage of inoculum appears to have a marked influence on the symptom expression in cucumber and squash. A consistent reduction in severity of symptoms was obtained when inoculum of CMV was diluted over certain ranges which depended on the variety of squash or cucumber inoculated and the original virus concentration.

The atomizing method of inoculation appears to be as uniform as the hand rubbing method. In tests in which the two methods were compared on paired cowpea leaves, the respective coefficients of variability were similar. This uniformity of inoculation is of particular significance to the plant breeder inasmuch as the atomized spray method is the only method adapted to inoculation of plants on an acre basis.

There are relatively high levels of resistance to CMV inherent in Cucurbita pepo L. 157 introductions were screened for resistance to CMV and selections of high resistance have been selected out of F.P.I. 177,371 and 174,192. These selections lack acceptable horticultural characters but appear promising as parental material for breeding C. pepos resistant to CMV. 71 pages. $1.00. MicA54-1330

A STUDY OF CONCENTRATE SPRAYING OF APPLE TREES WITH THE CORNELL EXPERIMENTAL ROTATABLE OUTLET MIST CONCENTRATE SPRAYER

(Publication No. 8199)

Maurie Semel, Ph. D.
Cornell University, 1954

An experimental rotatable outlet mist concentrate sprayer, constructed through the combined efforts of the Departments of Entomology and Agricultural Engineering at Cornell University in 1949, was employed during three years of field experimentation to determine the effects of various factors on the efficacy of concentrate sprays applied to apple trees.

Deposits of DDT were efficiently distributed throughout trees of moderate height with the use of this sprayer. However, data are presented to demonstrate that high, dense trees are difficult to cover evenly with concentrate sprays applied with the experimental apparatus, and deposition in the uppermost tree sectors is not as great as that in the lower sectors. It was found also that losses of toxicant, due to the forces of weathering, are higher in the upper regions.

An experiment designed to determine the effects of varying the concentration of toxicant within a tank mixture, and varying the dosage applied, demonstrated that effective control of codling moth and red-banded leaf roller, two of the most important pests of apple in the orchards of New York, is possible when the concentrate method is employed provided the quantity of actual toxicant applied per tree is equivalent to the amount normally applied by the dilute method. Decreased control-effectiveness was particularly evident in large, densely foliated trees when reduced quantities of actual toxicant were administered. Concentrations of toxicant, six, eight and ten times the normal dilute recommendation, were tested.

A wettable powder-DDT formulation, containing a minimum of conditioning agent, and especially prepared for the experiments to which a major share of the program was devoted, was shown to deposit greater quantities of DDT than a wettable powder-mixture of a standard DDT formulation available on the market for use in dilute sprays. The deposits of the former were also more highly tenacious. However, the degree of DDT deposition and retention on fruit and foliage surfaces was not positively correlated with the degree of codling moth control, and the standard material gave comparatively superior control.

A commercial spreader-sticker, added to a concentrate-mixture of standard wettable DDT powder, improved the tenaciousness of the resultant DDT deposits, but the increased residues were responsible for only slightly improved codling moth control. Somewhat greater residues were associated with deposits of this mixture on fruit surfaces and it is suggested that the adjuvant be omitted to prevent the retention of residue-excesses at harvest.

An assay of DDT deposits in the stem and calyx ends of the fruit revealed that dilute sprays were responsible for heavier deposits in these areas than comparable concentrate sprays. It is concluded that the dilute method is more efficient than the concentrate method in distributing spray materials throughout the sprayed trees.

Laboratory experiments showed that the presence of other spray ingredients in a concentrate-mixture containing a wettable DDT powder markedly affected the DDT-depositing capacity of the mixture. The study was limited in scope and did not include the possible effects of this change in depositing-efficiency on subsequent insect control.

200 pages. $2.50. MicA54-1331

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

SOME OBSERVATIONS ON THE EFFECTS OF CONDYLAR RESECTION ON THE GROWTH OF THE FACE AND CRANIUM OF THE WHITE RAT

(Publication No. 7042)

Joseph Rudolph Jarabak, Ph. D.
Northwestern University, 1953

A careful analysis of the work done on condylar resection as reported in the literature reveals that previous work was limited in scope. Moreover, observations were qualitative in character, and were restricted to changes in the morphology of the mandible as observed in disease rather than to those resulting from experimentally controlled condylar resection. There remain a number of basic problems to be explored, quantitatively. Four of these were dealt with in this investigation. These are:

1. The effect of mandibular condylar resection on neurocranial growth.
2. Measurement of morphological changes in the upper and lower face following condylar extirpation.
3. Changes in the increments and the vectars of growth in condylar resection was statistically investigated.
4. Morphological changes in the mandible resulting from either unilateral or bilateral condylar resection.

METHODS

Eighty rats were used in the roentgenographic and thirty in the morphological phases of this investigation.

(1) In the roentgenographic aspect of the study the rats were radiographed periodically after the resection of the condyles. For this purpose a special small animal cephalometer developed for this study was used to orient the cranium in three planes of space. Methods developed in human cephalometry were adapted for use in the linear and angular evaluation of the cranium and face. Fifteen linear and two angular measurements on each lateral roentgenogram were made. On the dorso-ventral roentgenogram two linear and four angular, and on the postero-anterior three linear measurements were recorded.

All of the measurements were made directly from the photographic enlargements (3.24 to 1) of the original roentgenograms and then these data were reduced by a corrective factor, one for roentgenographic and another for photographic enlargement. This procedure gave great accuracy in the measurement of small distances. The data were divided into the following categories: (a) the neurocranium, (b) upper face, (c) lower face, and (d) the mandible. These were then subjected to the analysis of variance to test the significance of condylar resection on them.

(2) The morphological phase of this investigation was made on thirty rats; one half of them had one condyle surgically removed and the other half had both condyles extirpated. The animals were then sacrificed (180 days post operatively) and the dried mandibles were studied morphologically.

The results of this data were divided into two categories. The first dealt with linear and angular changes of the face and cranium, and the second with morphological changes resulting from unilateral (first group) or bilateral (second group) condylar resections.

1. The linear measurements revealed the following:
   - 1.1 The neurocranium was least effected by condylar resection primarily because its growth was very nearly complete at the time the experiment was started.
   - 1.2 The length of the upper face in the horizontal direction was increased only in those instances where distal mandibular displacement occurred.
   - 1.3 The height of the upper face was greater in the more severe facial aplasias.
   - 1.4 The combined increase in the horizontal and vertical axises of growth of the upper face was due to the increase in the curvature of the upper incisor teeth; a sequelae of condylar resection.
   - 1.5 The mandible increased in the vertical direction in the region below the first lower molar tooth.
   - 1.6 There was no increase in the vertical dimension of the mandible in the region of the Antegonial notch.
   - 1.7 The increased antegonial concavity is due to emergency bone growth in the ramus of the mandible.
2. Morphological changes demonstrate the following:
   - 2.1 No reapposition of condylar structure was seen in some cases, and various degrees of reapposition were seen in other cases. This reapposition may or may not give the appearance of a normal condyle.
   - 2.2 Morphological changes in the coronoid process are the manifestation of the degree of mandibular posterior displacement.
   - 2.3 Changes in the degree of the ramus concavity were directly proportional to the degree of condylar reapposition; that is, the greater the reapposition the lesser were the morphological changes in the posterior border of the ascending ramus.

The significance of this study as a basis for a better understanding of disturbances of the temporomandibular joint seems pertinent.

750 pages. $9.38. MicA54-1332

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

THE EFFECTS OF RADIOACTIVE PHOSPHORUS (P^{32}) AND CORTISONE UPON THE RESPONSE OF MICE TO TRANSPLANTED MOUSE MAMMARY CANCER

(Publication No. 8112)

Norman Edward Boucher, Jr., Ph. D.
University of Minnesota, 1954

The preparation of susceptible recipient mice with radioactive phosphorus (P^{32}) and cortisone in combination resulted in an acceleration in development of subsequently implanted E0771 and Z8352 homologous tumor transplants. The tumor enhancive effect was manifested in test animals by a shorter time to death from cancer and by the earlier appearance and larger size of the cancerous growth when compared with untreated control mice. The employment of either cortisone or P^{32} singly for preparation of recipient animals was ineffective in inducing an enhancive effect. Moreover, each host-tumor combination differed in a) the dosage levels of P^{32} required in combination with cortisone for adequate preparatory treatment and b) the concentration of tumor cells which constituted an effective challenge inoculum for the demonstration of maximal tumor enhancement. The enhancive effect exerted by P^{32} and cortisone is apparently not limited to a single host-tumor combination since it was demonstrable in the transplantation of a) the Z8352 tumor to susceptible hybrid-backcross ZBC mice and to mice of the inbred C_3H strain of origin of this tumor and b) the E0771 tumor to mice of the inbred C57BL/6 strain of origin of this tumor. Finally, the tumor enhancive effect of P^{32} and cortisone was demonstrable in inbred C_3H mice implanted with heterologous E0771 tumor tissue. However, these agents were ineffective in accomplishing the transplantation of the highly specific inbred Z8352 tumor to alien C57BL/6 mice.

Since the tumor enhancive effect is demonstrable in homologous tumor-homozygous host combinations, the enhancive effect is presumably not associated with the presence of immunogenetic incompatibilities which may exist between the host and tumor. It is postulated that the enhancive effect induced by prior treatment with radiophosphorus and cortisone results from an alteration in the natural innate resistance of the host to implanted cancer cells.

106 pages. $1.33. MicA54-1333

TRICARBOXYLIC ACID CYCLE REACTIONS IN STREPTOMYCES GRISEUS

(Publication No. 8035)

Vernon Frank Coty, Ph. D.
Purdue University, 1954

Major Professors: Harold R. Garner and
Henry Koffler

A study was made of the ability of Streptomyces griseus strain E15-1 to utilize the Krebs tricarboxylic acid cycle as a means of terminal respiration. Extracts of cells which had been grown on a modified Waksman's medium were able to condense oxalacetate and acetyl phosphate to form citrate. By following the reduction of the pyridine nucleotides in a Beckman spectrophotometer, the preparations were shown to possess enzymes capable of oxidizing citrate, cis-aconitate, or isocitrate. These reactions, TPN-linked, led to the appearance of alpha-ketoglutarate. A reversal of isocitrate decarboxylation resulted from the addition of alpha-ketoglutarate, and either a solution of bicarbonate saturated with carbon dioxide, or a solution of ammonium chloride. Succinic dehydrogenase activity in the enzyme preparations was exhibited with the aid of methylene blue in Thunberg tubes. From a reaction on 2-C^{14} labeled succinate, a number of ether-soluble compounds and ether-insoluble material arose. Among them, fumarate, malate, pyruvate, acetate, and citrate were identified. Malic dehydrogenase, another TPN-linked enzyme in the E15-1 extracts, catalyzed the oxidation of malate to oxalacetate, and the latter product was instrumental in an oxidation of $TPN \cdot H_2$. In most of the foregoing cases, stoichiometric balances were found between substrate disappearance and product formation. The inhibitors, transaconitate, iodoacetate, malonate, and cyclohexanol seemed to act in a conventional manner. Streptomycin exhibited no effect on any of the reactions studied.

A comparison was made of the ability of intact cells of S. griseus grown on glucose and cell-free preparations of the same cells to metabolize several substrates. Though intact cells were incapable of respiring well on citrate, cis-aconitate, and malate, their extracts could react with these substances. After incubation with citrate for fourteen hours, the whole cells oxidized citrate strikingly, but not cis-aconitate or malate. The increased respiration on citrate was not accompanied by a similar increase in activity of the TPN-linked enzymes of the extracts.

On the basis of these results, it is concluded that cells of S. griseus strain E15-1 contained phosphotransacetylase, condensing enzyme, aconitase, isocitric dehydrogenase, succinic dehydrogenase, fumarase, and malic dehydrogenase, and therefore they are able to use the TCA cycle as a pathway of

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

metabolism. However, depending on the conditions of growth, permeability plays a role in the utilization of some exogenously supplied TCA compounds.

193 pages. $2.41. MicA54-1334

STUDIES ON AN AUTOLYTIC SUBSTANCE PRODUCED BY AN AEROBIC SPORE FORMING BACTERIUM

(Publication No. 7847)

Richard Aaron Greenberg, Ph. D.
University of Illinois, 1954

A research program investigating some of the fundamental properties of bacterial endospores is now in progress at the University of Illinois. As a part of this program, it was deemed necessary to study the factors involved in sporulation.

The aerobic spore forming bacterium Bacillus terminalis was selected for study. This organism produces acid, but no gas from glucose, xylose, salicyn and lactose and does not ferment mannitol and inositol. It reduces nitrate to nitrite, liquifies gelatin, hydrolyzes starch and produces acetylmethyl carbinol. No growth occurs at 55°C. Growth is observed in alkaline nutrient broth plus nitrate under anaerobiosis. The pH of cultures of B. terminalis after anaerobic growth in glucose broth drops to 5.0. According to the Smith Monograph of Aerobic Spore-forming Bacteria, (U. S. Department of Agriculture No. 16, (1952)) these characteristics are typical of B. cereus and B. licheniformis, with one exception in each case: B. licheniformis ferments mannitol and B. cereus does not ferment xylose.

A medium consisting of 0.2 per cent Difco yeast extract, 0.8 per cent glucose, 1.4 per cent ammonium sulfate, 0.2 per cent K_2HPO_4, 0.08 per cent magnesium sulfate heptahydrate and trace amounts of manganese, calcium, zinc, copper and ferrous iron, was employed for the growth of B. terminalis cells. The addition of 0.02 per cent manganese sulfate monohydrate to this medium rendered it highly sporogenic in the case of B. terminalis. The "G" medium mentioned henceforth in this discussion refers to the manganese-supplemented medium.

In a study of the effect of individual factors upon sporulation, it is desirable to separate vegetative cells from their growth medium. This has been done by Hardwick and Foster (J. Gen. Physiol. 35, 907 (1952)), who observed that young B. mycoides cells, resuspended in distilled water and shaken in air at 30°C., sporulate at approximately the same rate as cells left in the original growth medium.

A variation of this technique was employed in our laboratory as a means of studying the effect of individual substances upon the rate of sporulation of B. terminalis. When vegetative cells are suspended in the growth medium from which completely sporulated cultures were harvested, one finds present both sporogenic and asporulative substances. The stimulative substances are heat stable and are present before spores are detectable; the inhibitors are heat labile and appear after sporulation has gone to completion and autolysis of the vegetative extra-spore material has begun.

In order to investigate this phenomenon, the influence of several substances on the rate of sporulation was studied by adding them to washed cells suspended in pH 7.0 molar 30th phosphate buffer. The rate of spore formation was followed by making spore counts of the suspended cultures.

Those substances tested which stimulated spore formation were d- and l-alanine, lactate, pyruvate, aspartate, glutamate, malate, acetate, glycine and serine. Beta alanine and the ammonium ion did not affect the rate of sporulation of buffer-suspended cells. Glutathione and thioglycollate inhibited sporulation slightly, whereas cystine, homocystine, methionine, dinitrophenol and azide were strongly inhibitory. Dinitrophenol inhibition was overcome by the addition of an equimolar amount of alanine.

The substances which were most actively oxidized by resting cell suspensions of B. terminalis were the most stimulative to their sporulation rate. Those substances which had a deleterious effect upon spore formation or had no effect, were not oxidized at a detectable rate.

The attempt was then made to isolate and identify the heat-labile asporogenic factor present in supernatants from sporulated cultures. Ammonium sulfate precipitation of the supernatants revealed that the antisporulative factor was precipitated at .25-.45 saturation. Young vegetative cells suspended in pH 7.0 phosphate buffer or in buffer to which had been added material from the 0-.25 saturation cut, sporulated in about 10 hours. Similar cells suspended in buffer containing material salted out at 25-45 per cent ammonium sulfate saturation did not sporulate within 37 hours. It was also observed that cells placed in buffer solutions containing material precipitated at .45-.70 ammonium sulfate saturation were rapidly lysed.

During the investigation of factors affecting the sporulation of B. terminalis, it was observed that intracellular sporulation is almost complete in cultures growing in "G" medium before any "free" spores can be detected. Such cultures reach their maximum population density about 10-16 hours after inoculation. Approximately 24 hours after inoculation, intracellular spores can be detected microscopically, sporulation going to completion about 2-6 hours later. Once sporulation is complete, autolysis of vegetative residues clinging to the spore surfaces ensues, finally resulting in a culture of about 99 per cent free spores. The observation that young vegetative cells of the same organism were rapidly lysed following their suspension in buffer solutions of material precipitated at .45-.70 ammonium sulfate saturation from completely sporulated culture supernatants, suggested that an agent capable of freeing spores from their vegetative debris might be present in such supernatants.

Subsequent investigation showed that the B. terminalis autolytic agent was not present in detectable amounts in culture supernatants until the onset of

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

sporulation. Although it is believed that this substance is responsible for the lysis of the vegetative cells which contain spores, rapid lysis was observed only in the case of cells obtained from the exponential portion of the growth curve.

Examination of the B. terminalis autolytic substance has revealed some rather interesting properties. The material loses no lytic ability during 20 minutes of boiling and retains about 30 per cent of its activity after 30 minutes at 100°C. Dialysis against distilled water through cellophane removes no activity in 20 hours. Centrifugation at 12,000 gravities for one hour leaves all of the activity in the supernatant. The lytic agent has a pH activity peak in the range pH 5.0-5.5.

Data obtained from experiments in which susceptible cells were suspended in a series of various dilutions of active supernatant, imply a rather complex kinetics. It is very probably a multimolecular phenomenon, since the family of curves obtained from such an experiment show that dilution results in delay in the onset of lysis. The greater the dilution, the longer the curve shoulder. Lysis, when it begins in diluted supernatant, proceeds at a rate which also seems to be relatively characteristic of a given dilution.

It has been demonstrated that susceptible cells adsorb lytic material. B. terminalis cells suspended in active lytic supernatant for one minute at room temperature adsorbed about 30 per cent of the activity initially present in the supernatant. Some of these cells proceeded to lyse in buffer following their removal from the active supernatant in which they had been suspended.

Attempts to demonstrate the presence of any active lytic material within intact B. terminalis cells of various ages, were without success. Mechanical disruption of such cells released no detectable lytic material.

A very interesting fact revealed in the course of the work is the specificity of action displayed. Of a series of bacterial species tested, only B. terminalis and B. cereus proved to be highly susceptible to lysis by terminalis supernatant. The two strains of B. cereus studied also produced supernatants lytic to themselves as well as to B. terminalis. Previous investigation of the taxonomic characteristics of B. terminalis had suggested that this organism is a strain of B. cereus. The results obtained with the lytic material tend to confirm the conclusion that this is, in fact, the case.

Subsequent studies of supernatants taken from sporulated cultures of B. polymyxa showed that it also produces an autolytic material, but that it differs from the substance produced by B. terminalis. The optimum pH value differs; for B. polymyxa supernatant it is approximately 8.8, while for B. terminalis supernatant it is 5.3. Polymyxa supernatant will lyse B. polymyxa cells, but is not active against B. terminalis. The reverse is true of terminalis supernatant. Thus, these two lytic materials appear to be lytic only against those species which produce them. If further work demonstrates the presence of similar specific lytic materials in cultures of other members of the genus Bacillus, a new method of species identification may be possible.

48 pages. $1.00. MicA54-1335

THE EFFECT OF NATURALLY OCCURRING PLANT CONSTITUENTS ON THE HEAT RESISTANCE OF FOOD SPOILAGE ORGANISMS

(Publication No. 8047)

Glenn Douglas LaBaw, Ph. D.
Purdue University, 1954

Major Professor: Norman W. Desrosier

In the development of adequate process times for canned foods, various investigators have found that the heat resistance of typical spoilage organisms may vary considerably in foods of relatively similar composition and pH. It was postulated that the reduced thermoresistance of the spores of these food spoilage bacteria may be due to naturally occurring constituents inherent in the foods. This investigation was devised to study the effect of these naturally occurring plant constituents on the heat resistance of spores of several of the common food spoilage bacteria. The effects of these plant materials and those results noted for lupulon, subtilin, bacitracin, and several plant auxins were compared in heat resistance studies.

Ethanol and water extracts obtained from thirty edible plants were concentrated and were screened against typical test microorganisms, employing a modification of the agar-cup technique. The organisms used were Micrococcus pyogenes var. aureus, Escherichia coli, Bacillus subtilis, and Saccharomyces ellipsoideus.

Thirteen of the plants screened (carrot, celery, chard, chicory, cucumber, green bean, green pepper, okra, onion, rhubarb, sweet corn, tomato, and turnip) yielded extracts which were found to be active against one or more of the test species as indicated by zones of growth inhibition.

Three of these plant extracts (tomato, carrot, and green bean), purified lupulon (an antibiotic derived from hops), and indol-3-acetic acid (a plant auxin) were tested in spore destruction rate tests, employing spores of a flat-sour type organism. All of these substances markedly reduced the heat tolerance of the spores as indicated by thermal-destruction-rate curves.

Carrot extract, partially purified with ether, was further investigated in thermal resistance studies of several flat-sour bacteria and against Putrefactive Anaerobe No. 3679. Results indicated that the oily carrot extract varied in effectiveness in reducing the heat tolerance of the various species; this effect was dependent upon the heat resistance inherent in the microbial spore and upon the heating medium used.

Subtilin and bacitracin, purified antibiotics derived from B. subtilis, were also tested in spore destruction rate studies and were relatively ineffective in reducing the heat tolerance of several food spoilage

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

bacteria. Subtilin, however, was sporocidal against Flat Sour No. 787.

Synthetic plant auxins were also observed to be effective in reducing the thermal resistance of spores of food-spoilage organisms. Possible modes of action of these plant hormones against resistant spores were investigated. One possible site of action of the auxin would be a combination with various essential groups, such as the sulfhydral group, and/or the poisoning or denaturation of essential enzyme systems. Other possible mechanisms of action against the spores were also discussed.

Naturally occurring substances (carrot extract, lupulon, and alpha-naphthaleneacetic acid, an auxin) were tested in thermal-destruction-rate studies of heat resistant spores in several food menstra. Reduction in resistance to the effects of heat was observed in all cases; however, spores heated in a concentrated food, such as corn puree, were affected to a lesser degree than were those in buffer solution or in tomato juice (pH adjusted to 7.0).

144 pages. $1.80. MicA54-1336

PYRUVATE AND LACTATE OXIDIZING ENZYMES OF PROTEUS VULGARIS

(Publication No. 7805)

Harris S. Moyed, Ph. D.
University of Pennsylvania, 1954
Supervisor: Daniel J. O'Kane

PART I. ENZYMES OF THE PYRUVATE OXIDASE SYSTEM OF PROTEUS VULGARIS

The pyruvate oxidase system of Proteus vulgaris consists of two protein components: an autooxidizable, particulate cytochrome system containing pigments which have adsorption bands corresponding to cytochromes a_1, a_2, and b_1; and a soluble pyruvic dehydrogenase which has been purified 150 fold by ammonium sulfate fractionation, heat precipitation, and selective solubilization in dilute salt solution. The dehydrogenase can reduce 2,6-dichlorophenol indophenol and potassium ferricyanide; the cytochrome system greatly increases the rate of reduction of the artificial electron acceptors and enables oxygen to serve as the terminal oxidant.

Free acetate is found as the end product. Acetyl-coenzyme A and acetyl phosphate are not intermediates since they cannot be metabolized by the oxidase system under conditions which permit rapid pyruvate oxidation.

Diphosphopyridine nucleotide, coenzyme A, and lipoic acid, coenzymes required by acetyl-coenzyme A generating pyruvate oxidase systems, probably do not function in the pyruvate oxidase system of P. vulgaris. Diphosphopyridine nucleotide is not reduced by the system, it does not accelerate the oxidation of pyruvate, and its reduced form is not oxidized. The system is free of detectable coenzyme A, and the addition of this coenzyme does not increase the rate of pyruvate oxidation. The low levels of lipoic acid found in the system and the failure of arsenite (a known inhibitor of lipoic acid-linked systems) to inhibit the P. vulgaris system suggest the non-participation of lipoic acid. Diphosphothiamine, a coenzyme common to all pyruvate oxidizing enzyme systems, is required by the pyruvic dehydrogenase of P. vulgaris; however, this enzyme does not function in the acetyl-coenzyme A generating system.

It has been concluded that the existence of common intermediates and enzymes in both the P. vulgaris pyruvate oxidase system and the acetyl-coenzyme A generating system is doubtful.

PART II. THE L-LACTIC DEHYDROGENASE OF PROTEUS VULGARIS

A soluble L-lactic dehydrogenase has been extracted from dries cells of Proteus vulgaris by sonic oscillation. The oxidant is 2,6-dichlorophenol indophenol; the product of the oxidation is pyruvate; and the optimum pH is 7.4. The enzyme has been purified 200 fold by ammonium sulfate fractionation, heat precipitation, and adsorption on and elution from calcium phosphate gel.

The pyridine nucleotide coenzymes are not involved in the reaction as shown by the following facts: Diphosphopyridine nucleotide and triphosphopyridine nucleotide are not reduced by the enzyme; neither coenzyme accelerates the oxidation of lactate; and the reduced forms of the coenzymes are not oxidized by the enzyme in the presence of pyruvate. The preparation appears to be free of cytochrome pigments; the enzyme has a uniformly low light adsorption between 410 mμ and 680 mμ, and it does not show an increase in adsorption in this region of the spectrum upon the addition of hydrosulfite.

These properties and the behavior of the L-lactic dehydrogenase of P. vulgaris towards inhibitors distinguish it from the diphosphopyridine nucleotide-linked L-lactic dehydrogenase of mammalian muscle and from the cytochrome-linked L-lactic dehydrogenase of yeast. It is suggested that the bacterial enzyme is a third type of soluble L-lactic dehydrogenase.

66 pages. $1.00. MicA54-1354

INHERITANCE AND PHENOTYPIC EXPRESSION OF TYPE DIFFERENCE CHARACTERS IN BACTERIOPHAGE

(Publication No. 7877)

George Streisinger, Ph. D.
University of Illinois, 1954

The heredity of the levels of ultraviolet sensitivity, of the host ranges and of the serum neutralization rates that distinguish phages T2 and T4 has been shown to be mediated by specific genes. These have been located in the linkage map of T2L in relation to other genes.

The same gene controls the level of UV sensitivity, the extent of photoreactivability, and the evolution of intracellular UV sensitivity during phage development. Genotype and phenotype with regard to UV sensitivity always coincide.

One gene, or very closely linked genes, determine host range specificity and serotype specificity.

In phage particles produced in crosses involving different host range-serotype genes, the phenotype is often not homologous with the genotype. Phage of either T2-like or T4-like genotype may have T2-like phenotype, T-4 like phenotype, or a phenotype combining the T2 and T4 properties.

The alternative host range and serotype properties are regularly associated phenotypically as well as genotypically.

Our findings imply that the tail materials responsible for the host range and serotype properties are produced by the genetic material of the phage into an intracellular pool. These tail materials then become associated with the genetic material in a random manner.

86 pages. $1.08. MicA54-1337

BIOLOGY - GENETICS

STUDIES ON THE CONTROL OF OVULATION

(Publication No. 8030)

James Winslow Bastian, Ph. D.
Purdue University, 1954

Major Professor: M. X. Zarrow

I. Xenopus laevis

Studies were carried out with the South African clawed frog, Xenopus laevis, to determine the possibility of using the ovulatory response of this frog as a method for the bioassay of luteinizing hormone. A satisfactory method was developed for quantitation of the response which involved the numbers of eggs oviposited by the frogs. Specificity of the assay was not investigated completely, but no serious obstacles were encountered in any of the studies carried out. Sensitivity of the response is low, however, and is not sufficient for use with untreated sera.

Various other studies were made on the ovulatory response of Xenopus. Injections of 100 IU of chorionic gonadotropin every second day elicited a positive response for 58 days in seven of nine frogs. In other experiments ovarian sensitivity was shown to increase following subovulatory injections of chorionic gonadotropin. In view of these findings, certain changes in technique were recommended for the use of the female Xenopus frog in pregnancy tests. The suggestion is also made that the phenomenon of follicular sensitization resulting from subovulatory doses of gonadotropin might be an important factor in normal ovulatory cycles of other animals.

Ovulation was shown to be elicited in Xenopus by progesterone, desoxycorticosterone, testosterone propionate and cortisone acetate, but not by estradiol. There was found to be no synergism between progesterone and chorionic gonadotropin in their abilities to produce ovulation.

Hypophysectomy of Xenopus was found to cause no definite ovarian regression for 30 days following the operation. Desoxycorticosterone and progesterone were shown to continue to induce ovulation in Xenopus after hypophysectomy, confirming the belief that progesterone does not cause ovulation in Xenopus by stimulating gonadotropin releast from the pituitary.

Evidence is presented which shows that the ovary of Xenopus plays little or no part in the destruction of chorionic gonadotropin or its removal from the circulation. This is consistent with the hypothesis that the gonadotropins exert their effects catalytically.

II. The Domestic Hen

Experiments were conducted which show that both atropine and the adrenolytic agent SKF 501 are capable of partially blocking normal ovulation in hens. Near lethal doses of atropine were employed; however the SKF 501 was effective at dose levels below the lethal range. The action of atropine was shown to be independent of its side effect on central stimulation. Caution is suggested, however, in interpreting the results as indicating the existence of cholinergic and adrenergic links in the causal chain regulating the occurrence of ovulation. It seems also possible that the effect could be the result of some indirect interference with the mechanism controlling ovulation. This is particularly true with atropine since it was used in near lethal levels.

A recording of the daily activity cycle of a hen is shown which indicates a very strict regulation of the diurnal light-dark rhythm over the times of activity and sleep.

An experiment was conducted in which the daily period of wakefulness of hens was prolonged for several hours by enforced activity and light on the evening preceding the day of ovulation of the first follicle of the oncoming clutch. The results showed a delay in time of ovulation approximately equal to the number of hours of enforced activity. This is interpreted as indicating that the normal restriction of ovulation to a given part of the day is the result of a physiological inhibition of the mechanism for the release of follicles which is associated with the daily period of activity and light.

An hypothesis is presented to explain the peculiar cycle of ovulation in the hen. The major point in the hypothesis is the assumption that the mechanism for the release of follicles functions every night, even on the night before the day of the cycle on which no ovulation occurs. It is also assumed that the release mechanism operates at the same time every night,

even though ovulation occurs progressively later, and that it operates for a relatively long period, e.g., 8 hours. In addition, the concept supposes that the developing follicles are separated from one another by rather regular intervals of time. With these basic assumptions, it is shown how the cycle of ovulation in hens results from the interaction of two asynchronous cycles. These cycles are the release mechanism with a period of 24 hours and, what can be considered the cycle of production of mature follicles which usually has a period of from 24 to 48 hours.

Diagrams drawn on the basis of the above hypothesis suggested that yolk weight decreases with clutch position. An experiment was carried out to determine if this is actually so. The results for the two and three egg clutches were in agreement with the hypothesis, but an insufficient number of observations were available to permit a conclusion concerning the longer clutches.

Determinations of the thresholds for premature ovulation of follicles by exogenous gonadotropin at various intervals prior to their normal ovulation, also yielded data consistent with the hypothesis.

166 pages. $2.08. MicA54-1338

GROWTH AND SOME METABOLIC ASPECTS OF LARVAE OF THE BLOW-FLY PHORMIA REGINA (MEIG.) ON STERILE MEDIA

(Publication No. 7835)

Manfred Brust, Ph. D.
University of Illinois, 1954

A technique has been developed for the rearing of larvae of the black blow-fly, Phormia regina (Meig.), under germ-free conditions. Eggs are placed on paper squares and immersed in an 0.1% aqueous solution of Zephiran Chloride (Winthrop-Stearns, Inc., New York, N. Y.) for twenty-five minutes for the purpose of surface sterilization. The squares containing the eggs are then transferred to their individual autoclaved medium bottles by means of flamed forceps under routine sterile precautions. Success of this method was tested for by inoculating small portions of medium at the end of the incubation period into nutrient broth tubes. On the average, 91% of the cultures were found to be sterile. A fungicide, Methyl p-Hydroxybenzoate (Eastman Kodak Co., Rochester, N. Y.), was included in each diet. The eggs were incubated for four to six days at a temperature between 29°C and 30°C. The larvae in each medium bottle were weighed together after having been blotted clean individually. The average weight per larva in milligrams was recorded. Only living larvae were weighed. Pupation and emergence percentages were also recorded in some experiments. The larvae of three bottles containing the same media usually entered into the determination of any one value, i.e., weight, pupation or emergence, recorded in these experiments.

The following are the results obtained in these studies:

Larvae of Phormia regina will grow well on a medium having the following composition (per medium bottle):

(1)	Casein	4.000 gm
(2)	Salts (McCollum-Davis No. 185)	0.040 "
(3)	Cholesterol	0.040 "
(4)	Fungicide (see above)	0.090 "
(5)	Agar	0.160 "
(6)	Vitamin solution	0.48 ml
(7)	Water	14.0 "

When yeast is added to this medium, maximum weight will be reached 1-1/2 days earlier and this weight will be slightly greater than that attained on the yeast-free diet.

The vitamins absolutely required for growth and the minimum quantities per gram dry weight of diet that will support normal growth are as follows:

(1)	Thiamin	3 µgm/gm
(2)	Riboflavin	5.5 "
(3)	Nicotinic Acid	12 "
(4)	Pyridoxin	4 "
(5)	Pantothenic Acid	12 "

Some growth can take place in the absence of folic acid and choline, but the presence of these vitamins is required if normal growth rates are to be sustained. In the case of folic acid 0.25 µgm/gm dry weight of diet will support a normal growth rate, while 80 µgm/gm dry weight of diet of choline is needed for a normal growth rate. Omission of i-inositol from the diet had no effect on growth. Biotin requirements were not studied. The larvae cannot substitute l-tryptophane for nicotinic acid. A growth-accelerating factor is found in yeast which is apparently not absolutely required. This factor is heat stable and water soluble.

The larvae require sterols for normal growth. Cholesterol, ergosterol and sitosterol can meet this requirement while zymosterol cannot. In diets containing yeast no further sterol need be added.

Growth on diets containing ergosterol is slower than on diets containing cholesterol and the weight attained after six days is less. This leads to the supposition that ergosterol must undergo some conversion before being utilized, and that cholesterol does not have to be so converted.

Casein cannot be replaced by the water soluble Na-caseinate or enzymatic casein hydrolyzate.

Addition of sucrose has no effect on growth, while addition of potato starch inhibits growth.

Ribose nucleic acid (RNA), desoxyribose nucleic acid (DNA), adenine, guanine and uracil have no effect on growth either singly or in combination. All of them inhibit emergence of adults from the pupae. DNA promotes pupation by the larvae and is supported in this action by RNA although the latter alone has no such effect. Yeast also shows inhibition of emergence, but to a lesser extent than the nucleic acids, the purines and the pyrimidine. Yeast has no effect on pupation. 63 pages. $1.00. MicA54-1339

AN ANALYSIS OF THE HETEROSIS ENCOUNTERED IN LABORATORY CROSSES

(Publication No. 8119)

Arthur Warren Glass, Ph. D.
University of Minnesota, 1954

This study is an analysis of some of the physiological factors contributing to the superiority of a female inversion heterozygote over a related female which was homozygous for a chromosome lacking the inversion.

These females were obtained from a stock of Drosophila melanogaster which, from generation to generation, consisted of two types of females and two types of males. The one type of female (M5/wmf) was an inversion heterozygote and had a long inversion in one X-chromosome. This inversion was marked by apricot and Bar. The second type of female (wmf/wmf) was homozygous for an X-chromosome which lacked the inversion. This chromosome carried the markers white, miniature and forked. One of the males (M5) was hemizygous for the inversion chromosome whereas the second type of male (wmf) was hemizygous for the chromosome lacking the inversion.

Due to the fact that the inversion chromosome conferred semi-sterility and poor viability on flies which carried it in the hemizygous or homozygous condition, no inversion homozygotes and few inversion hemizygotes were found in culture bottles. There was then but one functional male — that hemizygous for the chromosome lacking the inversion. As proved in an experiment conducted under ideal conditions, this male mated randomly with the M5/wmf and wmf/wmf females.

Under these aforementioned conditions one would expect the "lethal" inversion chromosome to be eliminated from the population since its only source is the inversion heterozygote. However, stock bottles yielded consistently higher percentages of M5/wmf than wmf/wmf females. This could be possible only if the inversion heterozygote was the more successful of the two types of females, and if an equilibrium was established which was dependent upon this superiority.

The results of this study indicate that there are certain factors which might have contributed to the superiority of the inversion heterozygote.

There was a highly significant statistical difference in the number of females which contributed progeny to experimental vials. Of 189 M5/wmf females tested, there were 5 which were unsuccessful (all sterile). Of 188 wmf/wmf females tested, 12 were sterile and 19 died before producing progeny.

The mean lifetime total egg production for each of 25 M5/wmf females, was 351.32 ± 54.14. The same value for wmf/wmf females, was 116.28 ± 23.65. The mean total egg production per five-fly unit, for 5 units and over a 12-day period, was 1599.49 ± 39.61 eggs for M5/wmf females and 946.76 ± 86.43 eggs for the wmf/wmf females. The mean total egg production per ten-fly unit, for 5 units and over an eight-day period was 440.58 ± 32.92 eggs for the M5/wmf females and 175.80 ± 29.71 eggs for the wmf/wmf females. In addition the M5/wmf female enjoyed an early advantage in egg-laying.

Of 7958 eggs laid by M5/wmf females, 6413 hatched. 4949 of these larvae became adults. Of 4665 eggs laid by wmf/wmf females, 3228 hatched. 2411 of these larvae became adults.

The mean duration of life for 25 5M/wmf females, one to a unit, was 22.52 ± 2.26 days. The same value for wmf/wmf females was 15.52 ± 1.88 days. The median duration of life for 400 M5/wmf females, 100 to a unit, was 32.31 days. The same value for wmf/wmf females was 6.73 days. The mean duration of life in the absence of food, for 150 M5/wmf females was 46.19 ± 1.12 hours. The same value for the wmf/wmf females was 33.65 ± 0.75 hours.

The results of these experiments indicate that under certain conditions the M5/wmf female is superior to the wmf/wmf female. However, experimental conditions are not culture-bottle conditions, and due to the interaction of physiological factors within culture bottles a complete answer for the superiority of the M5/wmf female cannot be given.

119 pages. $1.49. MicA54-1340

THE EFFECT OF DIETS CONTAINING CORN OR SOYBEANS ON THE GROWTH OF TRIBOLIUM CONFUSUM DUV. AND TENEBRIO MOLITOR LINNE

(Publication No. 7853)

Herbert Lipke, Ph. D.
University of Illinois, 1954

The larvae of Tenebrio molitor were reared on basal diets containing various plant materials supplemented with the known growth inhibitors for this organism. Growth proceeded normally on wheat, buckwheat, rye, oats, sorghum, and barley. Corn and soy had a low nutritive value which could be improved by autoclaving. A study was made of the dietary value of unheated corn and soy for certain stored products insects. In this abstract, the term "basal" indicates that the diets were fortified with cholesterol, inorganic salts, and B-vitamins required for optimum growth.

I. Soy

The larvae of Tribolium confusum were observed to respond to raw and heated basal diets in an identical manner to the slower developing Tenebrio, therefore, this insect was used in this study.

Although it was known that methionine, amino acid mixtures, proteins of high biological value, trypsin powder, and thyroid-active substances improve the growth rate of vertebrates reared on raw soy diets, these materials had no beneficial effect on Tribolium. The addition of 2% dried brewer's yeast increased the body weight of the larvae, but growth was still inferior to that supported by autoclaved soy rations.

When heated soy basal diets were supplemented with soyin, or the crystalline trypsin inhibitor of Kunitz, or Bowman's EtOH soluble anti-trypsin, or the kaolin treated anti-trypsin of Ham et al., no significant decrease in the rate of larval development was observed. These inhibitors were added to the diets at levels in excess of those normally occurring in raw soy. A heat labile soy toxin, precipitable from a pH 4.6 extract of raw soy by .475 saturation with $(NH_4)_2SO_4$ was shown to be extremely toxic at the 2.5% level.

The anti-proteolytic activity of various soy fractions was determined in vitro using both proteases extracted from the larval gut, and commercial trypsin. The anti-trypsins described by Kunitz, Ham, and Bowman had no effect on the proteolytic activity of the insect enzyme preparation, but these substances blocked the vertebrate trypsin almost completely. The $(NH_4)_2SO_4$ fraction described above not only inhibited larval growth but proteolysis also.

When 5% raw soy was added to diets where the sources of nitrogen were either Rose's amino acid mixture, or casein hydrolysate, growth rates were observed that were considerably below those encountered when 5% heated soy replaced the raw legume. It was concluded that both indigestibility and the presence of an inhibitor whose action was antagonized by yeast were the causes of the poor nutritive value of raw soy for Tribolium and Tenebrio.

II. Corn

The poor growth rate accompanying the feeding of raw corn basal diets to Tenebrio was not changed by the addition of any of the following: Casein, yeast, liver, or combinations of tryptophane, lysine, threonine, methionine, or extra niacin and pyridoxine. These larvae have been shown not to convert tryptophane to niacin, and the failure of the above materials to exert a therapeutic effect indicated that raw corn contained an inhibitor toxic to the larvae in an addition to a nutritional deficiency per se.

Attempts were made to localize the inhibitor in the kernel by feeding various fractions of the kernel obtained by hand dissection. The germ region of the kernel was shown to be toxic when added to basal diets containing heated corn, or glucose and casein (20%), or glucose and brain protein (Wilson's "B").

When the deficiency of germ free corn in lysine and tryptophane was satisfied, this material proved equal to wheat in nutritive value. Reconstitution of the kernel by addition of de-fatted germ to this diet again depressed the growth rate. Autoclaving the germ destroyed the deleterious material in this tissue, so that basal diets containing raw germ free corn and heated germ had a high dietary value. Commercial wet or dry milled germ was not toxic to Tenebrio.

The low levels of germ (3 to 7%) required to inhibit larval growth indicated that such additions did not impose an imbalance in the diets to which it was added. The anti-niacin of Woolley and the corn bran inhibitor of Borrow et al. were non-toxic to Tenebrio. The role of the Tenebrio inhibitor in the corn-induced growth inhibitions observed in vertebrates is discussed. 151 pages. $1.89. MicA54-1341

DETECTION OF THE GENE FOR HUNTINGTON'S CHOREA

(Publication No. 8134)

John Daniel Palm, Ph. D.
University of Minnesota, 1954

A fertility study of choreics and their normal siblings has been carried out on a large sample of families who have had one member of their family institutionalized at the Kalamazoo State Hospital, Kalamazoo, Michigan. A similar sample of Minnesota families with particular emphasis on one large family group was used for comparison. A group of histories from the literature was also analyzed for the fertility of the choreics in comparison to their normal sibs. The results of the pilot study reported by Reed and Palm (1951) are included.

A group of 25 offspring of a choreic parent was tested to determine the possibility of predicting which members of this group will later develop the disorder. Electroencephalograms were recorded and psychological test procedures were employed. The psychometrics used were the Rorschach, MMPI, and Wechsler-Bellevue Intelligence test. Electroencephalograms were also obtained from eight persons with clinical manifestations of the disease.

In all fecundity comparisons the choreic persons had more children than did their sibs who did not develop the disease. It is suggested that the increased fecundity may be an effect of the gene on the psychosociological attitudes that normally result in control of family size.

Low voltage fast activity was found in 13 of the 25 electroencephalograms recorded on the offspring of choreic persons in one family group. The observation of 50 per cent low voltage fast activity is unusually high and would indicate that this half of the group is the half with the gene for the disease.

The psychometrics did not categorize the group as distinctly as did the electroencephalograms. No dichotomy of the group was possible on the basis of the Wechsler-Bellevue Test nor did the subtest scores of this test reveal any distinct peculiarities of the group.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

No peculiar response patterns were found in the Rorschach test. The abnormal Rorschach tests were not significantly correlated with the abnormal electroencephalograms.

Subconscious defensiveness and a conversion V pattern in the neurotic triad distinguished 13 of the 24 MMPI profiles from normal patterns. These were not correlated significantly with abnormal Rorschachs or abnormal electroencephalograms of the same persons.

Prediction of incipient chorea is not possible when all of the tests are considered equally valid in detecting manifestations of the gene because of the random association of the various abnormal records with each other.

We may postulate that the EEG is a more sensitive test for detecting the gene for Huntington's chorea before its overt expression has occurred but that the psychometrics are of value in analyzing the socio-psychological effects of anxiety about the disorder. 61 pages. $1.00. MicA54-1342

BOTANY

A STUDY OF THE INHERITANCE OF EXPANSION IN POPCORN

(Publication No. 8033)

Gerald Clary, Ph. D.
Purdue University, 1954

Major Professor: D. E. Nelson, Jr.

Studies were conducted to check a previously reported linkage between the locus (P) for cob color and factors influencing expansion. Such a linkage was found in Supergold 18 and Baby Golden 1708. This linkage was not present in South American 24 or Hulless 1001. Linkage between genes influencing expansion and silk color was found in Supergold 18.

The type of pollen effecting fertilization has been thought to have little or no immediate effect upon expansion. This point was investigated and it was found that pollen does have an effect upon expansion in segregating populations resulting from pop-dent corn crosses. Xenia could not be demonstrated in the inbred dent corn tested.

Translocations were used to determine the position of some of the factors influencing expansion in Supergold 18, Supergold 1533, Supergold 67, Supergold 1491, and Iowa 28. Linkages between various points of translocation and factors influencing expansion were found in all of the lines tested except Iowa 28.

The translocation studies indicated linkage between factors influencing expansion and the points of breakage in the following inbred lines and translocation stocks:

Inbred	Translocation(s)		
Supergold 18	1-10b	3-6c	1-4b
Supergold 67	4-5f		
Supergold 1491	XR-26	3-6c	
Supergold 1533		3-6c	

The position and number of the effective factors in the Supergold inbreds were dissimilar indicating that further mass selection within the parent variety followed by a system of recurrent selection would be profitable.

An investigation of the nature of general and specific combining ability possessed by popcorn inbred lines was undertaken. It was found that those inbred lines which could be considered good general combiners had a number of effective factors for expansion which the poor combining lines did not have. The lines that appeared to behave in an unpredictable manner in hybrid combinations were found to have a large interaction component in some crosses involving these particular inbreds but not in others. This would indicate that the interaction detected was due, in part at least, to epistatic effects. The behavior of the popcorn inbreds in single crosses and threeway crosses was examined. It appeared that differences in expansion between crosses was due to differences in the number of effective factors present in the lines as well as to differences in the mode of inheritance of expansion.

The components of variance due to dominance and interaction were computed for crosses between Supergold 18 and Hy, and between Baby Golden 1708 and Hy. A comparison of the variance components of the two series of pop-dent corn crosses indicate that the mode of inheritance of expansion is different in these two inbreds.

Estimates of the minimum number of effective factors for expansion by which the dent corn inbred Hy and Supergold 18 and Hy and Baby Golden 1708 differ were obtained. It appears that at least 1-2 factors in Baby Golden 1708 and 3-5 factors in Supergold 18 constitute this difference.

93 pages. $1.16. MicA54-1343

AN INVESTIGATION OF THE WILTING PHENOMENON IN VERTICILLIUM WILT OF TOMATO LYCOPERSICUM ESCULENTUM MILL

(Publication No. 8040)

Ralph J. Green, Jr., Ph. D.
Purdue University, 1954

Major Professor: C. L. Porter

This research has demonstrated that there are at least three fractions produced in vitro by Verticillium

albo-atrum R. & B., isolated from tomato, which may be associated with the wilt symptoms induced in test cuttings of susceptible tomato plants. These three fractions are: (a) excess nitrite ion accumulations, (b) a complex polysaccharide fraction, and (c) a proteinaceous fraction. Only the latter proved to be of primary significance.

It was clearly demonstrated that both the nitrite fraction and the polysaccharide, though present in culture solution, were apparently metabolic by-products and could not be demonstrated to be of importance in the wilt symptoms induced. The polysaccharide fraction was responsible for vascular gummosis but only in the absence of the wilt-inducing proteinaceous fraction.

The proteinaceous material was demonstrated to be a product of autolysis by comparing the appearance of this fraction in the culture solution to the normal growth curve of the fungus, V. albo-atrum #9.

Studies of the transpirational rates of inoculated and non-inoculated plants revealed that there is a marked difference in the rates observed but this variation is not typical of responses expected.

Both aerial and subterranean symptoms were considered and it was demonstrated that acropetal chlorosis and necrosis, not wilting, are the primary symptoms of this disease. In addition, the significance of the environment, especially temperature ranges, on disease development was determined.

Evidence is presented to show that primary wilting is a reversible reaction and that chlorosis and necrosis are progressive and proceed independently of the wilt reaction.

An exhaustive study was made of the distribution and rate of spread of V. albo-atrum #9 within the host tissues under conditions favorable for infection. The results reveal that the pathogen may occur throughout the plant system in as few as six days after inoculation. This is usually in advance of all but the most primary symptoms.

Histological studies of infected plant stems and leaves demonstrate the nature of the host-parasite associations and the thrombosis of vascular elements. The primary causes of vascular discoloration are also revealed.

The results of this research demonstrate conclusively that the wilting phenomenon associated with Verticillium wilt of tomato is not the result of a translocated toxin produced either by the fungus or as a result of the host-parasite association. Rather, the host responses are the direct result of the invasion of the host tissues by the pathogen.

104 pages, $1.30. MicA54-1344

STUDIES ON THE VERTICILLIUM WILT OF MENTHA PIPERITA L., WITH SPECIAL EMPHASIS ON THE CAUSAL ORGANISM, VERTICILLIUM ALBO-ATRUM R. & B.

(Publication No. 8051)

John Virgil Luck, Ph.D.
Purdue University, 1954

Major Professor: C. L. Porter

Verticillium wilt of peppermint is the most serious disease of the crop. Primarily due to the presence of this organism, the cultivation of Mentha piperita is no longer economically profitable in many areas of the Midwestern muck lands. In recent years the disease has made its presence known in the volcanic soils of the Oregon and Washington mint growing areas.

Since 1947, the Beech-Nut Packing Company has made funds available to C. L. Porter for the conductance of research on various aspects of this disease with special regards to the causal organism, Verticillium albo-atrum R. & B. It has been the purpose of this research to correlate and extend some of these findings.

It has been determined that the pathogen can persist in muck soils under field conditions for at least four years in the absence of known susceptible hosts. Greenhouse experiments indicated that this survival was not the result of saprophytic activity, but due to the resting microsclerotial stage of this fungus. In the absence of a susceptible host, the mycelium and spores of this pathogen were not able to persist in muck soil for longer than five months.

As a criterion of the general resistance of these structures, their resistance to moist heat, desiccation, ammonia, and formaldehyde was determined. With respect to these criteria, the microsclerotia of Verticillium are much more resistant than the larger sclerotia of many Fungi Imperfecti. On this basis, it can be assumed that in the absence of mitigating circumstances these structures could lie quiescent in the soil for many years.

The enigma of why diseased planting stock can be planted to virgin soils without resulting in a disease incidence equal to that in the fields from which the plants were obtained was investigated. The explanation of this phenomenon was believed to be revealed by the following findings. No nutrient is present in virgin muck soil that can delay or prevent symptom expression in the infected plant. The pathogen is confined to the vascular elements of the host until the death of the host is intimate. Since under favorable conditions an infected plant may persist the entire growing season before dying, considerable time is required for the fungus to be released to the soil. And finally, infected peppermint plants produce disease-free surface runners, which initiate new disease-free plants. These plants will remain disease-free until the inoculum has built up sufficiently in the soil. Often this involves a period of several years.

Attempts at premunity of mint plants, using a

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

fungus tentatively identified as a member of the genus Bispora, were unsuccessful. This organism is frequently isolated from the vascular system of completely asymptomatic plants.

The need for standard rooting procedures was shown. Within limits, the time required for infection to take place was found to be a function of the root development of the host plant. In addition, the need for proper temperature controls in indexing the inoculum potential of a soil was demonstrated.

In order to carry out germination studies and to obtain a method for separating sclerotia from the soil, an attempt to determine the specific gravity of sclerotia and mycelium was made. A method for determining these values is given. The specific gravity of mycelium was found to be fairly constant. However, the specific gravity of sclerotia fluctuated considerably. The values obtained for sclerotia were not enough unlike that of particles of muck soil to allow the use of this method in recovering these structures from the soil.

Respiration studies demonstrated that sclerotial formation would not occur in the Mandel-Sui respirometer flasks due to the lowered CO_2 tension occasioned by the KOH solution. A technique to circumvent this difficulty is presented. Subsequent investigation indicated that CO_2 fixation is involved during microsclerotia formation by Verticillium albo-atrum B11B. 131 pages. $1.64. MicA54-1345

STUDIES ON STEMPHYLIUM LEAFSPOT OF ALFALFA

(Publication No. 8130)

Richard Robert Nelson, Ph. D.
University of Minnesota, 1954

Investigations on the mycological, pathogical and etiological aspects of Stemphylium leafspot of alfalfa, caused by Stemphylium botryosum, have shown that the disease is an important problem in Minnesota for several reasons. The association of the conidial stage, which is apparently identical to S. botryosum, with Pseudoplea briosiana demonstrated that the pathogen is present in one or the other stage from early spring until late fall. Furthermore, the association of Stemphylium with Pseudoplea raises the question of proper nomenclature, since previous writers have associated S. botryosum with Pleospora herbarum.

The fungus overwinters principally as immature perithecia on plant debris and possibly in dormant plant tissues. Symptoms from ascospore infections appear in early spring and the infection cycle of ascospores to ascospores is repeated several times until early July. From July to the end of the growing season, the pathogen is perpetuated only by the conidial stage. Immature perithecia develop on dead or senile plants in late fall, indicating the beginning of the overwintering phase of the pathogen.

The pathogen infects leaflets, stems, petioles, peduncles, pods and seeds of alfalfa, causing defoliation, wilting and dwarfing. Entire stems are killed and seeds can become infected but the greatest loss is from defoliation.

In the greenhouse approximately 70 per cent of the infected leaflets dropped from the plants in less than 4 weeks. The amount of defoliation is determined directly by the position and numbers of lesions, petiole infection, size of lesions when correlated with position, and age of plants. Virtually all leaflets drop if lesions are on the petioles or basal areas of the leaflets. Alfalfa is most susceptible when the plants are in the flowering stage.

Stemphylium leafspot depresses both yield and quality of alfalfa seed. Losses in yield are caused directly by fewer pods produced, fewer seeds per pod and lighter seeds. Losses in quality of alfalfa seed are caused by a lower germination percentage of infected seed and by the production of dark colored, shriveled seed. Losses in yield and quality are caused indirectly by infections on the stems, leaves, petioles, and peduncles of alfalfa.

The potential importance of Stemphylium leafspot during any given year is dependent largely upon moisture and temperature. The optimum conditions for initial infection are temperatures of 18-24° C. with 100 percent relative humidity for at least 12 hours. However, after symptoms become visible, temperature has more effect than moisture in further development of the disease. Moderate temperatures are most conducive for disease development.

There are cultural and parasitic races of the pathogen. Parasitic races differ in their ability to attack other forage species and in their degree and type of infection on alfalfa clones and varieties. There is a great amount of genetic variation among isolates derived from the conidial and ascigerous stages of the fungus. Single spore isolates differ in color of colonies, topography, presence and absence of sporulation, zonations, and appressed versus fluffy mycelial growth.

The pathogen has a wide host range among forage species, including several of the more important clovers. Information on the host range and the presence of parasitic races is particularly important in the development of varieties of alfalfa resistant to Stemphylium leafspot. Clones and varieties of alfalfa should be tested for their resistance to a large number of isolates of the pathogen obtained from several forage hosts and should be tested under as many conditions as possible over a period of years in order to select material which is truly resistant.

64 pages. $1.00. MicA54-1346

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

CHEMISTRY, GENERAL

THE EFFECTS OF HIGH ENERGY RADIATION ON NON-AQUEOUS SYSTEMS

(Publication No. 7829)

Paul Emmanuel Bierstedt, Jr., Ph.D.
University of Illinois, 1954

The effects of x-rays on dithizone (I), p-dimethylaminoazobenzene (II), 2-hydroxy-4-nitrophenylazo-β-naphthol (III), and resazurin (IV) dissolved in non-aqueous solvents were investigated for potential dosimetric properties. Compounds I and II, dissolved in both chloroform and carbon tetrachloride had a radiation sensitivity dependent upon the solvent. When a one ml. volume of 3×10^{-4} M I in chloroform was irradiated with 1500 r, 1.9×10^{16} molecules were oxidized. When the solvent was carbon tetrachloride, 750 r caused 2.2×10^{16} molecules to be oxidized. In this instance, I was approximately twice as radio-sensitive in carbon tetrachloride as it was in chloroform. Upon irradiation the solutions changed in color from green to yellow. When a one ml. volume of 4×10^{-4} M II dissolved in chloroform was irradiated with 2250 r, 3.1×10^{16} molecules reacted with the radiation produced free radicals. When the solvent was carbon tetrachloride a similar dosage caused 2.2×10^{16} molecules to react, and thus II was more radio-sensitive in chloroform than in carbon tetrachloride. The effects of the radiation were dependent upon the solvent, for in a chloroform solution of II, the color changes from yellow to red upon irradiation, which indicates that the red acid salt of II is formed by the irradiation produced acid. In carbon tetrachloride, the color of the solution changes to a lighter yellow, and thus indicates that the irradiation of carbon tetrachloride produces no acid.

Compounds III and IV were dissolved in absolute ethanol, and these solutions were mixed with varying amounts of halogenated hydrocarbons as sensitizers before irradiation. When a two-ml. volume of 2×10^{-4} M III containing 50% chloroform was irradiated with 3000 r, 1.5×10^{17} molecules reacted, and when 50% carbon tetrachloride was present only 1000 r were required to cause 1.6×10^{17} molecules to react. In this case, the irradiation changed the color of the solution from purple to orange. Thus carbon tetrachloride is a much better sensitizer than chloroform. When a two ml. volume of 1×10^{-4} M IV containing 80% chloroform was irradiated with 3000 r, 4.8×10^{16} molecules reacted with the radiation products and when 80% carbon tetrachloride was present only 500 r were required to cause 8.5×10^{16} molecules to react. The irradiation caused the color of the solution to change from blue to red-orange, carbon tetrachloride being the better sensitizer.

A dosimeter solution was prepared by dissolving compounds III and IV in ethanol containing various amounts of carbon tetrachloride to obtain the desired range of sensitivity. This mixed solute system was more stable than either single solute system. These solutions were temperature and dosage-rate independent and were successfully used to register dosage from an atomic burst at the Nevada Proving Grounds in March 1953.

The radio sensitivity of the above compounds were compared on the basis of their G and M values. Both compounds III and IV, dissolved in a mixed ethanol-carbon tetrachloride solvent exhibited approximately the same degree of radio sensitivity. Reasonable free radical mechanisms of all the systems are postulated.

124 pages. $1.55. MicA54-1347

I. SOME QUANTITATIVE AND QUALITATIVE ANALYTICAL APPLICATIONS OF A NEW GEIGER COUNTER X-RAY DIFFRACTOMETER. II. AN X-RAY INVESTIGATION OF SOME UNSOLVED SUGAR PROBLEMS. III. THE REACTIONS OF SOLUTIONS OF MOLYBDENUM CARBONYL IN OIL ON METAL SURFACES.

(Publication No. 7830)

Stephen John Bodnar, Ph.D.
University of Illinois, 1954

I. A. Quantitative Analysis of Industrial Dusts for Quartz

A recently purchased General Electric XRD-3D x-ray Diffractometer has been applied to the quantitative analysis of quartz using the internal standard method. A standard series, using calcium fluoride as in internal standard and amorphous silica as a diluent, in the range 10 - 100 percent quartz was prepared in 10 percent increments and a standard curve set up. The stability and reproducibility of the instrument is such that this curve will be valid as long as the instrument operates. The best operational conditions, a stepwise procedure, and an indication of the reproducibility of the measurements are given. Analyses of three synthetic mixtures gave results within the accepted limits. The results of the analyses of twenty-one samples of industrial dusts collected in two large steel foundries for their quartz content are listed.

B. Qualitative Analysis of the Products of Several High Temperature Reactions

A comparison is given of the performance in qualitative analysis of the older x-ray diffractometers, available in this laboratory, with that of the recently purchased General Electric XRD-3D. The best operational conditions are given according to the amount

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

and degree of crystallinity of the sample. Three series of high temperature reactions were studied. The first of these was the preparation of $BaO{\cdot}6Fe_2O_3$, a magnetically hard material, by mixing stoichiometric amounts of $BaCO_3$ and Fe_2O_3 and heating until reaction took place. A study was made of the metallic products of a thermo-chemical preparation for cerium-calcium alloys by the reaction of a rare earth oxides mixture, containing predominately ceric oxide, sodium nitrate, and calcium-silicon or silicon. The reaction products of thermo-chemical mixtures of rutile, sodium nitrate and calcium-silicon and rutile, sodium nitrate and iron-silicon were physically separated into several fractions. The components of these fractions were identified. The diffractometric patterns of the various fractions of a given mixture were compared with each other and with similar fractions of other mixtures.

II. This part of the thesis deals with the study of the unfermentable reducing substances found in a sample of cane molasses from Formosa. The 2,4-dinitrophenyhydrazine derivatives were prepared. Melting point determinations did not agree with those of any of those compounds usually found in canes. X-ray powder diffraction patterns and infrared spectra were taken for several fractions. These were compared with those of ten specially prepared known derivatives. The diffraction data for some of these have not been previously available. All diffraction data are tabulated and reproductions of the infrared spectra are included. Results of the micro analyses of several portions of a high-melting fraction are given. Because the diffraction data, melting points, and micro analyses of this high-melting fraction do not agree with those of any known derivative, it is strongly suspected that a new compound, with an empirical formula $C_4H_4O_3$ which is possibly a homolog of reductic acid, is present.

III. The structure of molybdenum disulfide is such that it is finding use as a high temperature, high pressure, solid lubricant. It has generally been used as such or mixed as a colloidal solid suspension with conventional lubricants. An attempt has been made to form a solid, adherent, self-healing, thin film of molybdenum disulfide on bearing surfaces by a homogeneous reaction of molybdenum hexacarbonyl and zinc thiophosphate cyclohexanol in oil under conditions of bearing temperature and pressure. Solutions of molybdenum carbonyl, in oils containing various concentrations of zinc thiophosphate cyclohexanol, were prepared by induced solubility and by prolonged stirring of the oils in contact with the finely ground solid. The latter method was superior to the former. A quantitative estimation of the concentration of molybdenum hexacarbonyl is possible by applying Beer's law to infrared determinations in the range below 300 mg./200 ml. of oil. The solutions were used to lubricate the bearing of an Almen machine. After the period of lubrication, the bearing shaft became coated with a black film. Attempts were made to identify these films by electron diffraction, x-ray diffraction, and x-ray fluorescent methods. Iron (II) sulfide was identified as being present. No molybdenum or molybdenum disulfide could be detected, possibly because the amount present was so small that the analytical techniques used were not of sufficient sensitivity. 145 pages. $1.81. MicA54-1348

SPECTROGRAPHIC DETERMINATION OF ZINC IN PLANT MATERIALS

(Publication No. 7854)

Ricardo Taningco Marfori, Ph.D.
University of Illinois, 1954

Introduction

Zinc is needed by plants in very small amounts for their growth and reproduction. Zinc deficiency occurs in wide areas in the United States and affects many agricultural plants. The principal crops affected are the pecan, citrus, tung, peach, apple, apricot, cherry, raspberry, grape, avocado, mango, corn, sugar cane, sugar beet, tomato, peanut, and pea. Zinc deficiency in citrus has been reported in almost all parts of the world where citrus is grown. Zinc deficiency in apples has been reported also in various countries of Europe.

Rapid and fairly accurate spectrographic analyses of leaves have been reported of value in diagnosing deficiencies of certain essential trace elements in plants, but such spectrographic methods are not available for zinc. The chemical methods for quantitative determination of zinc in plant materials are rather tedious and time-consuming. On the other hand, the known spectrographic methods for quantitative determination of zinc in plant materials are not quite satisfactory. The really rapid spectrographic methods for zinc have been shown to give large errors, while those that are claimed to give a high degree of accuracy involve procedures for concentrating or isolating zinc from interfering elements that are as time-consuming and tedious as the chemical methods. To develop or devise a rapid and accurate spectrographic method for determining zinc quantitatively in plant materials was, therefore, the objective of this investigation.

Experimental Methods

In order to evaluate the spectrographic procedures tried, the zinc contents of 39 samples of whole soybean plants, soybean leaves, and alfalfa stems and leaves were determined chemically by the A.O.A.C. dithizone method. Since the objective was to develop a rapid and accurate spectrographic method, the first procedure tried was the simplest, namely, that which uses ground plant material, unashed or untreated, for direct excitation of zinc spectra, principally the Zn line 3345.02 Å. Then excitation of briquetted plant material, without and with spectroscopic buffer, using the Cd line 3261.057 Å as internal standard for the Zn line 3345.02 Å, was tried.

Next tried was excitation of plant ash, without and with spectroscopic buffer, for the same Zn and Cd lines. Having tried these methods with three electrical sources of energy for excitation, namely, the D. C. arc, A. C. arc, and A. C. spark for the utilization of the Zn and Cd line pair without getting a good working

curve, use of another working pair of spectral lines, namely the Zn line 2138.56 Å with the Te line 2142.75 Å as internal standard, was then studied. This pair of spectral lines required spectroscopic plates especially sensitized for the far ultraviolet region of the spectrum. Essentially the same methods tried for the utilization of the Zn-Cd line pair was also tried for the use of the Zn-Te line pair.

Results and Summary

The workability of an analytical method is determined by its reproducibility or precision, and accuracy. In this investigation the accuracy of the spectrographic method being tried was tested by comparison with the chemical method. Of the different spectrographic methods tried, the most promising one, as far as workability is concerned, was that which made use of plant ash with a suitable buffer (e. g. Li_2CO_3) and D. C. arc excitation of the Zn line 2138.56 Å, using the Te line 2142.75 Å as a reference line. Preliminary trials with a specific kind of plant material (leaf samples) showed that, of the acceptable determinations, the greatest percentage of error from the chemical method was about 21 per cent. This may be permissible for a rapid survey of plant materials. 104 pages. $1.30. MicA54-1349

STUDIES IN THE DIELS-ALDER REACTION WITH NITROÖLEFINS AND UNSYMMETRICAL BUTADIENES

(Publication No. 8084)

William T. Norton, Ph.D.
Princeton University, 1953

Part I

The Diels-Alder reaction with β-nitrostyrenes has been extended to include the unsymmetrical diene, isoprene. Isoprene adds to β-nitrostyrene and 4-methoxy-β-nitrostyrene to form, in both cases, a high yield of a mixture of two isomeric adducts. In the case of isoprene and β-nitrostyrene, the two adducts, 1-methyl-4-nitro-5-phenylcyclohexene (IXa) and 1-methyl-5-nitro-4-phenylcyclohexene (IXb), form an inseparable mixture, which can be transformed by the Nef reaction to a mixture of 4-methyl-6-phenyl-3-cyclohexen-1-one (Xa) and 3-methyl-6-phenyl-2-cyclohexen-1-one (XIb) which are separable. In the case of isoprene and 4-methoxy-β-nitrostyrene, the two adducts formed, 5-(4-methoxyphenyl)-1-methyl-4-nitrocyclohexene (XIVa) and 4-(4-methoxyphenyl)-1-methyl-5-nitrocyclohexene (XIVb), are separable and are present in the ratio of five parts of XIVa to one part of XIVb, which approximates the ratio of IXa to IXb as ascertained from the amounts of transformation products. When XIVa and XIVb are subjected independently to the Nef reaction, 6-(4-methoxyphenyl)-4-methyl-3-cyclohexen-1-one (XVa) and 6-(4-methoxyphenyl)-3-methyl-2-cyclohexen-1-one (XVIb) are formed, respectively.

Neither of the two unconjugated ketones, Xa and XVa, could be converted with acid to their conjugated isomers, nor could the unconjugated isomers of the two conjugated ketones, XIb and XVIb, be isolated from the Nef reaction product. An explanation of these facts is to be had from a consideration of the hyperconjugation forms of these eight compounds.

Structures were assigned to Xa and XIb by examination of their ultraviolet absorption spectra and by the transformation of Xa to the known 4-methyl-2-phenylphenol. Structures were assigned to the compounds in the series derived from 4-methoxy-β-nitrostyrene by examination of the ultraviolet absorption spectra of the ketones in the series and by analogy with Xa.

Part II

The Diene Synthesis utilizing β-nitrostyrenes and substituted butadienes seemed to offer an interesting route to the synthesis of lycoramine (XXVI), an alkaloid of the Amaryllidaceae. The starting material necessary for this considered synthesis is 3-ethyl-5-(3-methoxyphenyl)-4-nitrocyclohexene (XXXIV), presumably obtainable as the adduct of the Diels-Alder reaction between 3-methoxy-β-nitrostyrene and hexadiene-1,3. Two isomeric compounds are obtained from this Diene Synthesis. In order to establish the structure of these two isomers, an attempt was made to convert them to the corresponding α, β- unsaturated ketones by the Nef reaction followed by refluxing with dilute acid. The structures of the two ketones which could be obtained, 2-ethyl-6-(3-methoxyphenyl)-2-cyclohexen-1-one (XXXVI) and 5-ethyl-6-(3-methoxyphenyl)-2-cyclohexen-1-one (XXXVII), could be determined from their ultraviolet absorption spectra. However, only negligible amounts of ketonic material were obtained from these reactions. Investigation of another method of structure proof which involved degradation of the two adducts to the 3′-methoxybiphenyl-2-(and 3)-carboxylic acids also proved fruitless.

The problem of the structure proof of XXXIV was temporarily dropped, and some more readily available model compounds were used to help discover the best synthetic approach to lycoramine. The previously prepared compound, XIVa, was used in studying reduction and hydroxylation reactions. Compound XIVa was hydroxylated with performic acid to furnish in good yield 1,2-dihydroxy-5-(4-methoxyphenyl)-1-methyl-4-nitrocyclohexane (XLI). This nitroglycol, XLI, was reduced with platinum oxide and hydrogen to afford 4-amino-1,2-dihydroxy-5-(4-methoxyphenyl)-1-methylcyclohexanehydrochloride (XLII) in high yield. Reduction of XIVa with lithium aluminum hydride gave 4-amino-5-(4-methoxyphenyl)-1-methylcyclohexenehydrochloride (XLIII), which could not be cyclized by the Pictet-Spengler method to 7-methoxy-3-methyl-1,4,4a,9,10,10a-hexahydrophenanthridinehydrochloride (XLIV) because of the unfavorably placed methoxyl group.

A closer analog of XXXIV was to be found in the adduct obtained from the condensation of butadiene with 3-methoxy-β-nitrostyrene, 4-(3-methoxyphenyl)-5-nitrocyclohexene (XLV). It was the intention to use this compound as the starting material for the

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

investigation of all the synthetic steps in the projected series leading toward lycoramine, and ultimately arrive at the desired compound in this series, desethyllycoramine (XLIX). Reduction of XLV with lithium aluminum hydride gave two isomeric amine hydrochlorides in moderate yield. These two amine salts are undoubtedly the cis and trans isomers of 4-amino-5-(3-methoxyphenyl) cyclohexenehydrochloride (XLVI). Cyclization of the isomer of XLVI formed in the greater amount (XLVIa) afforded 6-methoxy-1, 4,4a,9,10,10a-hexahydrophenanthridinehydrochloride (XLVII) plus a small amount of another uncharacterized amine hydrochloride. The secondary amine, XLVII, was N-methylated successfully with formaldehyde and formic acid to furnish 6-methoxy-10-methyl-1,4,4a,9,10,10a-hexahydrophenanthridinehydrochloride (XLVIII) in high yield. Performic acid oxidation of the double bond of XLVIII, to form the glycol, desethyllycoramine (XLIX), met with no success. A crystalline compound was obtained in which it appears one of the hydroxyl groups of XLIX has been substituted with a chlorine atom.

The assigned structures of the hydrophenanthridines in this series are corroborated by evidence obtained from their infrared absorption spectra.

103 pages. $1.29. MicA54-1350

FORMATION AND STABILITY OF SOME COMPLEXES OF IRON AND VANADIUM

(Publication No. 8145)

Paul Edward Toren, Ph.D.
University of Minnesota, 1954

Nitroprusside gives three reduction waves at the dropping mercury electrode, the first two being hydrogen ion independent, and probably corresponding to simple one electron transfer reactions. The reaction between nitroprusside and hydroxyl follows the equation: $Fe(CN)_5NO^{-2} + OH^- \rightleftharpoons Fe(CN)_5NO_2^{-4} + H^+$ · $Fe(CN)_5NO^{-2}$ is reduced at the mercury electrode, but is not oxidized at the platinum electrode. $Fe(CN)_5NO_2^{-4}$ is oxidized at the platinum electrode, but is not reduced at the mercury electrode. The constant, $K = [Fe(CN)_5NO^{-2}][OH^-]/[Fe(CN)_5NO_2^{-4}]$ is 9×10^{-7} at 25° C and ionic strength 0.5.

The dissociation constants of N,N′-dihydroxyethyl glycine (DHEG) are $pK_1 = 2.50$ and $pK_2 = 8.11$ at an ionic strength of 0.5. The ferric-ferrous redox reaction in the presence of DHEG is reversible at the dropping mercury electrode in alkaline medium, and follows the equation $FeG(OH)_2 + G^- + e \rightleftharpoons FeG_2 + 2OH^-$, where DHEG is taken as a monobasic acid HG. Potentiometric measurements showed that the electrode reaction was $FeG(OH)_2 + e \rightleftharpoons Fe^{+2} + G^- + 2OH^-$ from pH 3 to pH 5. The stability constant of the ferric complex is of the order of 10^{30}, and the ratio of the stability constants of the ferric and ferrous complexes involved in the electrode reaction is $10^{24.2}$.

The anodic polarography of alkaline vanadium (IV) solutions was studied with results confirming in general those previously published. The irreversible double wave found in some solutions can be eliminated by aging the solutions for several days before recording the wave.

Mixtures of vanadyl sulfate and sodium citrate are blue-violet, and show absorption maxima at 303 and 560 millimicrons. Titration curves showed the presence of $VO(OH)Cit^{-2}$, and the presence of $VOCit^-$ and/or VO(HCit). By assuming the height of the absorption maxima to be proportional to the concentration of $VO(OH)Cit^{-2}$, an equation was derived relating the absorption, the pH, the total citrate concentration, and the stability constants of the vanadyl citrate complexes. A simplified form of this equation was found to be consistant with the observed spectrophotometric data.

A manual polarograph circuit was developed which allowed a current-voltage measurement to be made with a single galvanometer null point measurement, and without the application of a correction factor.

155 pages. $1.94. MicA54-1351

CHEMISTRY, BIOLOGICAL

INTERACTIVE EFFECTS OF COUMARIN, DITHIOOXAMIDE, ASCORBIC ACID AND AUXINS UPON THE EARLY DEVELOPMENT OF ROOTS

(Publication No. 8062)

Jacques Marie Alamercery, Ph.D.
Michigan State College, 1952

The interactive effects of dithiooxamide and of ascorbic acid upon the development of roots and its inhibition by coumarin and by the "auxins" 2,4-D, indole-acetic acid and naphthalene-acetic acid have been investigated in Petri dishes under controlled conditions of light and of temperature, with cucumber for root-elongation and lettuce for germination percentage.

Treatments of dithiooxamide which were stimulative in light were strongly inhibitive in darkness for the elongation of cucumber roots; no stimulation has been observed in darkness; the inhibitions induced by higher concentrations of dithiooxamide, whether in light or in darkness, were not considerable before the third day after that germination had started. Dithiooxamide was able to increase the early low rates of lettuce germination in light at 29° C., or in darkness at 25°C.. Ascorbic acid alone did not produce any significant effects on the development of roots at the concentrations which were used (below 2,000 ppm).

Ascorbic acid was able to reinforce synergistically or to reduce the inhibitions of cucumber root elongation induced by dithiooxamide, depending upon the conditions of illumination, the procedure of testing (simultaneous or successive applications of the chemicals) and the order and the length of the treatments, in the case of successive applications of the chemicals.

Both dithiooxamide and ascorbic acid were able to reduce the inhibition of cucumber root elongation

induced by coumarin, in light only in the case of dithiooxamide, in both light and darkness in the case of ascorbic acid. A similar reduction of the inhibition of lettuce germination induced by coumarin was produced by both chemicals, in light and darkness by dithiooxamide and in light only by ascorbic acid in the case of simultaneous applications with coumarin throughout the experiments; for both chemicals, it took place in darkness only, when they were separately applied after a presoaking of the seeds in a solution of coumarin alone in darkness (case of an artificial dormancy). Ascorbic acid was more potent in the case of cucumber, dithiooxamide was more potent in the case of lettuce.

Both dithiooxamide and ascorbic acid were able to reduce the inhibitions of cucumber root elongation induced by the "auxins" 2,4-D, indoleacetic acid, and naphthalene-acetic acid, both in light and in darkness. In every case, ascorbic acid was more potent than dithiooxamide.

As a tentative interpretation of the interactive effects of dithiooxamide, ascorbic acid, and coumarin, a natural biological system is outlined in which -SH groups and coumarin derivatives may be independently interrelated with the metabolism of Vitamin C in plants, directly or indirectly through the metabolism of -SH enzymes. Two phases of this system appear likely to be interfered with by the "auxins".

233 pages. $2.91. MicA54-1352

PART I: AN INVESTIGATION OF SOME BIOCHEMICAL PROPERTIES OF THE DENTAL PLAQUE. PART II: THE SYNTHESIS OF SOME N-STEAROYL DERIVATIVES OF AMINO ACIDS AND RELATED COMPOUNDS AS POSSIBLE INHIBITORS OF DENTAL CARIES.

(Publication No. 6227)

Blake William Moore, Ph.D.
Northwestern University, 1953

Part I

A method was developed for determining pH values and lactate contents of samples of dental plaque weighing (dry) between 200 and 600 micrograms. Simultaneous analyses of pH values and lactate contents of plaques were made from each of 101 caries-susceptible individuals, before and at intervals after fifty percent sucrose mouth rinse. In general, the lactate content reached a maximum about the same time as the pH reached a minimum (ten to fifteen minutes after sugar). The actual titration curve, against lactic acid, for a large sample of pooled plaque was compared with the regression of pH on percent lactate for the data on the 101 caries-susceptible individuals. The amounts of lactate which accumulated in plaques of these individuals were sufficient, in general, to account for the observed falls in pH, on the basis of this comparison. Furthermore, the lowest minimum pH values were, in general, associated with the greatest increases in lactate.

It was concluded that within the twenty minute period studied that: (a) lactic acid accumulates in significant quantities in plaque in situ after sugar; and (b) lactic acid is probably the only acid formed which contributes significantly to the pH drop.

Part II

A method was developed for synthesizing N-Stearoyl derivatives of amino acids, peptides, and related compounds in pure form and in high yields by reacting stearoyl chloride with the amino acid (or peptide) ethyl ester in an anhydrous medium, and subsequently hydrolyzing the esters to give the free acids. The N-stearoyl derivatives of glycine, glycine hydrazide, alanine, alanine hydrazide, methionine, glutamic acid, delta-aminocaproic acid, glycylglycine, 2-aminoethanol, and morpholine were made.

These compounds were tested for properties of inhibition of acid formation from glucose by saliva in vitro. Several were found to be good inhibitors in this test, and warrant further investigation as possible caries inhibitors. 122 pages. $1.53. MicA54-1353

THE BIOCHEMICAL FUNCTIONS OF SOY FLOUR IN WHITE BREAD PRODUCTION

(Publication No. 7290)

James Marshall Pollock, Ph.D.
University of Minnesota, 1953

The potential nutritional advantages of soy flour as a bread constituent have never been realized, due primarily to functional disadvantages. This investigation was undertaken to examine the hope of obtaining information of value in improving soy flour processing techniques and baking procedures.

Raw soy flour, specially prepared without heat treatment, was defatted by cold extraction with hexane. Analytical data showed the product to be similar to most commercial soy flours, except that nitrogen dispersibility and enzymatic activity values were higher. Baking tests employed to compare the raw soy flour and a series of heat-treated samples prepared from it indicated a deleterious effect associated with heating. Later tests showed that the inclusion of an oxidizing dough improver produced an advantage in favor of a properly heated soy flour.

To examine individually the effects of soy flour constituents, the unheated material was fractionated by such relatively mild methods as water or dilute acid extraction and dialysis. The soy flour fractions, with and without controlled heat treatments, were tested in a small scale laboratory baking test, in which response to an oxidizing improver could be evaluated.

Although nearly all soy flour fractions were somewhat deleterious, the most injurious fractions were encountered in the dialysate from the supernatant after precipitation of the bulk of the protein contained in the water-soluble fraction. Still another dialysate

fraction contained most of the undesirable flavor principle, although it was otherwise of fair baking quality.

A proteinaceous fraction, unprecipitated with the bulk of the protein, was excellent in baking quality; this fraction also showed high anti-tryptic activity.

Several fractions, including the most deleterious ones, responded somewhat in baking quality to the presence of potassium bromate. The baking qualities of individual fractions were variously affected by controlled heat treatment.

Soy flour fractions which had materially influenced baking performance were studied further by analytical methods. Determination of chlorides and of sulfhydryl groups demonstrated that these constituents were not responsible for adverse effects in baking tests. Chromatographic determination of sugars showed large quantities distributed among the dialysate subfractions, but provided evidence that the sugars were not responsible for adverse baking effects.

Ion exchange treatment of the two most injurious fractions pointed to the ionic character of the active constituents. Ash determinations demonstrated these injurious fractions to be extremely high in inorganic constituents. Quantitative analysis indicated significant levels of zinc, calcium, magnesium and phosphate ions. In baking tests employing these ions as salts, in amounts calculated to correspond to the effective level of the single most active soy flour fraction, calcium and magnesium salts improved the bread, while phosphate and zinc salts were quite injurious. The influence of zinc was remarkable in view of its low level.

A study of gas production and retention as a function of fermentation time demonstrated that zinc and phosphate in the amounts employed in the baking tests retarded gas production, whereas the adverse effects of raw soy flour itself, and of soy bean protein (a major constituent) were primarily on gas retention. Thus, the inorganic constituents, which appeared to be significant in the baking behavior of certain soy flour fractions, may be of relatively little importance in the performance of soy flour itself.

The results do not offer promise for the improvement of the baking quality of soy flour by removing any specific constituents. They suggest, however, that satisfactory bread containing a moderate level of soy flour might be obtained by the careful application of heat during soy flour processing, and the use of oxidizing agents in the dough, plus adjustment of fermentation schedules.

227 pages. $2.84. MicA54-1355

STUDIES ON THE METABOLISM OF CERTAIN STEROIDS BY LIVER PROTEIN FRACTIONS

(Publication No. 7873)

Arthur Allan Smucker, Ph.D.
University of Illinois, 1954

Introduction

There are a number of references in the literature implicating unusual patterns of estrogen metabolism in certain types of cancer. Present knowledge regarding the metabolism of estrogens is only fragmentary. In vivo and in vitro experiments have shown that estrogens are enzymatically altered so as to be biologically inert in the presence of liver tissue or extracts. It would be desirable to obtain a purified enzyme preparation capable of catalyzing such inactivation, in order to study more easily the course of the reaction. A study was therefore undertaken to select a chemical determination for estrogens which could be used in measuring the inactivating capacity of various fractions of liver tissue. In order to correlate more readily such a chemical determination with biological activity, a detailed study of a bioassay, using methods of statistical analysis, was also made.

Discussion of Results

A detailed study was made of the uterine weight bioassay for estrogens, applying methods of statistical analysis. The precision of the method when varying numbers of assay animals are used has been clearly defined. The method was used to show conversion of estradiol-17β to biologically inert products, and to confirm previous reports that DPN is a co-factor in such conversion.

A modified Zimmerman determination for 17-keto steroids was used to show the appearance of estrone upon incubation of estradiol-17β with aqueous liver extracts. However, it was concluded that this is not the most useful method for following the enzyme or enzymes through a protein fractionation procedure.

It would appear that the fluorometric determination involving the use of sulfuric acid is the chemical method which best combines specificity, sensitivity and precision. Some form of purification is necessary before chemical methods of any sort may be applied to the determination of estrogens in incubation mixtures. Paper strip chromatography seems to represent the most suitable such purification method.

Exploratory studies using the fluorometric method alone failed to show inactivation by liver tissue of estradiol-17β present in relatively large amounts.

A preliminary study was made in which estradiol-17β was incubated with liver homogenate at a fairly low level. Determination was by paper chromatographic purification followed by fluorometric measurement. It appears that there was some disappearance of estradiol, but the results are not clear and require further investigation. This finding was not tested by bioassay. 125 pages. $1.56. MicA54-1356

ADENOSINETRIPHOSPHATASE IN THE RED AND THE WHITE MUSCLE

(Publication No. 8201)

Joseph Tonzetich, Ph.D.
Cornell University, 1954

Distinct physiological and biochemical differences have been reported between the red and the white striated muscle. The object of the present work was to determine if the reported differences also extend to muscle ATPase. This information might provide an explanation for the numerous reported discrepancies on the characteristics of the enzyme. It could also aid in the understanding of the dissimilarities in the mechanism of contraction that exist between the red and the white straited muscle.

A series of experiments was conducted to study the differences in the character of the ATPase extractable from the red and the white muscle. The solubility, pH optimum, activating and inhibiting agents of the enzyme derived from the two muscle sources were compared. Tissue samples for these analyses were obtained from 40 mature female fowl.

Solubility

The ATPase preparations from the two muscle sources were found to differ in the nature of their solubility. Red muscle yielded an ATPase preparation extract that was soluble both in water and dilute KCl. The parallel enzyme activities observed with the water and KCl soluble preparations indicated that both procedures eluted the identical ATPase from the red muscle. On the other hand, the aqueous extract of white muscle possessed no ATPase activity. It is noteworthy that the white muscle KCl extracts showed considerably greater ensymatic activity than the corresponding red muscle extracts. The KCl extracts of the water-insoluble white muscle residues yielded ATPase activity comparable to the direct KCl extracts. The results were interpreted to indicate that all ATPase preparations were devoid of myosin.

pH

A single peak of activity for both the red and the white muscle ATPase was observed at pH 6.9.

Specificity

The activity of the ATPase obtained from both muscle sources, regardless of the method of extraction, was specifically associated with the liberation of the terminal phosphate from ATP. None of the preparations catalyzed the hydrolysis of 5-adenylic acid, sodium inorganic pyrophosphate, glucose-1-phosphate, glucose-6-phosphate, or fructose-1-6-diphosphate.

Activation

Magnesium was the most effective activator of ATPase. Manganous ion activated the enzyme from both muscle sources, but proved to be only fifty percent as effective as Mg. The ability of Ca was limited to a modest activation of only the white muscle ATPase preparations.

Inhibition

The presence of Ca in concentrations equivalent to that of Mg nullified the activation capacity of the latter ion. Where both Mg and Mn were present, in a system, the expected influence of Mn on the ATPase took precedence over that of Mg.

Fluoride effectively inhibited all of the systems to which it was added. However it had no effect on the residual activity. Octyl alcohol inhibited ATPase and even markedly depressed the residual activity. The residual activity did not appear to be accomplished through the sulfhydryl group of the enzyme. Both glutathione and cysteine failed to influence any of the systems to which they were added.

Dialysis

Dialysis of the various systems failed to remove any factor necessary for ATPase activity. The residual activity, which did not appear to be related to sulfhydryl group of the enzyme, remained unchanged after dialysis.

Evidence was presented to support the following general conclusions:

1. That a single enzyme was being dealt with in both muscles.
2. That the differences in the enzyme properties between the two muscle sources were due to associated particulate matter from which ATPase could not be separated.

144 pages. $1.80. MicA54-1357

PURIFICATION OF WHEAT ALPHA- AND BETA-AMYLASES

(Publication No. 8146)

Cecil Craig Walden, Ph.D.
University of Minnesota, 1954

Studies have been conducted on the purification of alpha-amylase and beta-amylase.

Spectral transmittance curves were obtained for the colors produced by the action of alpha-amylase, in the presence of excess beta-amylase, on a beta-limit dextrin substrate. Selecting a wavelength of 650 millimicrons as that wavelength where a linear relationship between transmittance and time of reaction existed, as compared to existing procedures, calibration curves were established relating the transmittance of an unknown sample at a given time to its alpha-amylase activity. The standard error of the determination was approximately 6%. This was associated mainly with the preparation of the alpha-amylase extract and not preparation of the substrates. Differences obtaining between substrates originating from different starch sources could be largely eliminated by adjusting the resulting substrates on the basis of their beta-limit dextrin content. Use of an extraction period in excess of 6 1/2 minutes with a Waring Blendor resulted in an overall short method for the determination of alpha-amylase activity in malt sources.

Alpha-amylase could be extracted from malted wheat flour in sufficient percentage for continuing

purification by 120 minutes stirring with 0.2% calcium acetate solution at 30°C. Alpha-amylase retained its activity in crude preparations on standing in the presence of toluene and thymol. A seven day autolysis period was necessary to secure clarification of alpha-amylase preparations preceding the elimination of beta-amylase by a heat treatment at 70°C. Elimination of the beta-amylase by heat at pH values recommended in the literature, resulted in excessive loss of alpha-amylase activity. A maximum alpha-amylase activity retention during heat treatment was observed between pH values of 6.5 to 8.5. Data indicated that acetone would be an excellent fractionating agent for wheat malt alpha-amylase.

Considerable increase in the release of beta-amylase was observed in flour-water suspensions when sodium chloride was present. Maximum beta-amylase activity resulted within 18 hours. Sodium chloride did not activate beta-amylase, but appeared to release it by action on flour constituents which were both water and sodium chloride insoluble. Mixing was not necessary for beta-amylase production. A kinetic study of beta-amylase production showed a maximum rate and a maximum final value at 1% sodium chloride concentration. Higher concentrations of sodium chloride showed a diminished initial rate of beta-amylase production, with the final values attained at longer time intervals being the same. At sodium chloride concentrations below 1%, beta-amylase was produced at a diminished initial rate and the total quantity produced was also lower.

Final purification of beta-amylase involved the fractionation of a sodium chloride flour extract with acetone twice and saturated ammonium sulfate solution once. Attempted crystallization yielded a product showing regular formations on microscopic examination. The activity nitrogen ratio of the final preparation was 11.8 times that of the same ratio for the initial crude extract. A specific solubility test did not indicate the presence of any protein fraction other than beta-amylase. Alpha-amylase and proteinases were absent, while traces of phosphatase were present. The activity nitrogen ratio of the final preparation compared favourably with data from the literature for crystalline beta-amylase from sweet potatoes. 174 pages. $2.18. MicA54-1358

SPECTROPHOTOMETRIC STUDY OF SOME METAL CHELATE COMPLEXES

(Publication No. 7884)

Donald Harry Wilkins, Ph.D.
University of Illinois, 1954

New spectrophotometric reagents and procedures for the determination of iron, copper and cobalt are described and additional data is provided for systematic predictions resulting in reagents of improved properties.

A series of substituted 2,2′-diquinolines has been studied. The most sensitive known diquinoline derivative yet described as a reagent for copper has been investigated. It has been shown that the most effective groups and positions of substitution previously described for 1,10-phenanthroline are also applicable to 2,2′-diquinoline.

New derivatives of 1,10-phenanthroline have been investigated. The dialkylaminoalkylamino derivatives are described as sensitive reagents for iron. Their broad absorption maximum makes them adaptable to procedures where a filter type spectrophotometer must be used. It has been demonstrated that multiple bromo substitutions are undesirable. This data can safely be applied to other halogen derivatives and to 2,2′-diquinolines and 2,2′,2″-terpyridines.

New copper specific reagents have been investigated and a procedure for the determination of copper in steel is given. 2,9-Di-methyl-4,7,-diphenyl-1,10-phenanthroline is the most sensitive known reagent specific in the determination of copper.

A new procedure for the simultaneous determination of copper and iron with 1,10-phenanthroline has been developed. It has been shown that the bis-1,10-phenanthroline copper (I) complex may be extracted from aqueous solution thus increasing the value of this reagent.

The phenomenon of increasing the molecular extinction coefficient by substitutions in a parent compound have been extended to terpyridine. Two new derivatives, terosine and terosole, have been investigated. Terosole is the most sensitive reagent for iron yet described. Terosine and terosole are also better reagents for cobalt than the unsubstituted terpyridine. A procedure is given for the determination of iron in the presence of cobalt with terosine. A new compound, 2,6-bis-(4-phenylpyridine)-4-phenylpyridine (terosite), is suggested for iron and cobalt determination.

Suggestions are made for improved analytical reagents for iron, copper and cobalt.

112 pages. $1.40. MicA54-1369

CHEMISTRY, INORGANIC

PRECISE pH MEASUREMENTS WITH THE HIGH RESISTANCE GLASS ELECTRODE

(Publication No. 7561)

Robert Max Engelbrecht, Ph.D.
State University of Iowa, 1954

It was the object of this investigation to see if pH measurements with the high resistance glass electrode could be made with a precision and an accuracy of better than ±0.01 pH units. Commercial pH meters have a rated accuracy of ±0.02 pH units. All studies requiring accurate pH data would benefit if the accuracy of pH measurements were improved.

Three Beckman model "G" pH meters were studied extensively. This instrument has an intrinsic sensitivity of ±0.002 pH units; the accuracy, however, is limited to ±0.02 pH units since the direct reading pH

scale is calibrated in tenths of a pH unit. Modifying this instrument by mounting a measuring microscope over the direct reading scale enables pH to be read to a thousandth of a pH unit. A circuit with a Leeds and Northrup amplifier and a type "K" potentiometer was another instrument studied extensively. The Cambridge pH meter "Research Model" was also investigated; but our model was found to be sensitive only to ±0.02 pH units.

Solutions covering the pH range from 1.0 to 13.0 were tested over a period of a week to a month. At least three measurements were made with the same electrode, all on different days. The reproducibility of pH measurements with all three pH meters as well as with the amplifier instrument was found to be ±0.002 pH units.

The pH values of the same solutions were measured with the hydrogen electrode. It was found that the average error of the pH measurements with the Beckman pH meter and the amplifier-potentiometer instrument was ±0.006 pH units.

Since the accuracy of pH measurements is below the precision of measurements, an attempt was made to find the cause for this difference. Errors which might be attributed to the specific chemical nature of the solutions were investigated. In the extreme acid region (pH 1.0) large negative errors were found; this is in accordance with previous investigations and is to be expected. The error became negligible above pH 2.0. No definite error was found in the extreme alkaline region (pH 11.0 to 13.0) with solutions containing potassium as the cation. This is contrary to previous studies which have shown errors as large as 0.1 pH units for 0.1M potassium solutions. This difference is attributed to the type of electrode used; in our work we employed the Beckman general purpose type electrode. It may be concluded that no errors may be attributed to the potassium ion in the extreme alkaline range using this type of electrode.

We attempted to find errors in the pH meter itself. With the aid of the measuring microscope it was found that the direct reading pH scale of the Beckman pH meter was not accurately calibrated. Using the pH meter as a potentiometer showed that the slide wire was not uniform. An experiment showing that no current is drawn from the cell in e.m.f. measurement indicated that the circuit of the Beckman pH meter is very good. A pH meter as much like the Beckman as possible with a uniform slide wire and an accurately calibrated pH scale would be very desirable.

This investigation has shown that pH measurements with the high resistance glass electrode may be made with a precision and an accuracy of better than ±0.01 pH units.

55 pages. $1.00. MicA54-1359

COMPOUNDS OF HIGH NITROGEN CONTENT

(Publication No. 7846)

Paul Gene Gordon, Ph.D.
University of Illinois, 1954

I. Allophanyl Hydrazide

Allophanyl hydrazide is readily prepared in good yield by the hydrazinolysis of methyl and ethyl allophanate (84% and 81% of theory, respectively) in methanolic solutions under reflux temperature conditions: $H_2NCONHCO_2R + N_2H_4 \rightarrow H_2NCONHCON_2H_3 + ROH$. The esters of allophanic acid are prepared from urea and the corresponding chlorocarbonic ester. Allophanyl hydrazide is a white crystalline material which melts at 166° C. with decomposition and is soluble in water, methanol, and ethanol.

Allophanyl hydrazide has been further characterized by preparation of the corresponding hydrazones with salicylaldehyde, anisaldehyde, cyclohexanone, and p-chloroacetophenone; reaction with benzaldehyde and acetone was verified. The compound reacts as a typical primary hydrazide as evidenced by the fact that it will undergo cyanate, thiocyanate, and cyanamide condensation reactions to form 1-allophanyl semicarbazide, 1-allophanyl thiosemicarbazide, and 1-allophanyl aminoguanidine, respectively.

Allophanyl hydrazide is converted to a stable azide by nitrous acid; the azide is useful for introducing the allophanyl group, $H_2NCONHCO-$, onto ammonia, hydrazine, allophanyl hydrazide, and guanazole. The hydrazide undergoes reaction with methyl chlorocarbonate to form 1-allophanyl methyl carbazinate, and with p-acetamidobenzenesulfonyl chloride to give a compound which after hydrolysis of the acetyl group is 1-sulfanilamidobiuret. The hydrazide forms salts with hydrochloric acid, nitric acid, picric acid, and oxalic acid; the pK_b was found to be approximately 11 in aqueous medium. Prolonged heating at 120-130° C. brings about partial cyclization-deammonation of allophanyl hydrazide to urazole.

II. Urazole

A new and superior synthesis of urazole has been developed which makes use of readily available raw materials and gives a good yield of product. The various steps involved in the preparation of urazole are: a) conversion of urea into an allophanic ester by treatment with a chlorocarbonic ester, b) hydrazinolysis of the allophanic ester by refluxing with aqueous hydrazine to give hydrazine urazolate (83% of theory for the methyl ester), c) conversion of hydrazine urazolate to urazole by refluxing with acetone (94% conversion) to give an over-all 78% yield of urazole

a) $2H_2NCONH_2 + ROCOCl \longrightarrow H_2NCONHCO_2R + H_2NCONH_2 \cdot HCl$

b) $H_2NCONHCO_2R + 2N_2H_4 \cdot H_2O \longrightarrow HNNHCONHCO \cdot N_2H_4 + ROH + NH_3 + 2H_2O$

c) $HNNHCONHCO \cdot N_2H_4 + 2CH_3COCH_3 \longrightarrow HNNHCONHCO + (CH_3)_2C{:}NN{:}C(CH_3)_2 + 2H_2O$

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Urazole is a white crystalline material which melts at 249-50° C. with decomposition; it is acid to litmus and exhibits an acid dissociation constant of 1.6×10^{-6} in aqueous medium. Attempts to prepare urazole by the cyclization-deammonation of biurea, $H_2NCONHNHCONH_2$, with heat, acid, base, and thionyl chloride were unsuccessful; hydrazinolysis of biuret produced poor yields of urazole.

III. Guanazole

Hydrazination of dicyanamide according to equation a) and of dicyandiamide under controlled pH and temperature conditions according to equation b) produces guanazole in 75% and 95% yields, respectively. Guanazole is a white crystalline compound which melts at 203-4° C. with decomposition; it is very soluble in water, soluble in methanol, and difficulty soluble in ethanol. The compound is alkaline to litmus and has a base dissociation constant of 5.6×10^{-10} in aqueous medium.

a) $HN(CN)_2 + N_2H_4 \longrightarrow H\underline{NNHC(NH)NHC}(NH)$

b) $H_2NC(NH)NHCN + N_2H_4 \longrightarrow H\underline{NNHC(NH)NHC}(NH) + NH_3$

Attempts to prepare a mono- and dinitroso derivative of guanazole resulted in the formation of highly colored water insoluble products which could not be purified, and gave negative Liebermann nitroso tests. Guanazole undergoes a cyanate condensation reaction to give 3-ureido-5-amino-1,2,4-triazole. 1-Phenylguanazole is prepared by the reaction of phenylhydrazine hydrochloride with dicyandiamide. The following salts of guanazole were prepared: a) nitrate, b) picrate, c) oxalate, d) hydrochloride, e) sulfate.

150 pages. $1.88. MicA54-1360

A PHASE STUDY OF THE PRASEODYMIUM OXIDE SYSTEM AND THE TERBIUM OXIDE SYSTEM

(Publication No. 7564)

Eugene Daniel Guth, Ph.D.
State University of Iowa, 1954

The oxides of terbium and praseodymium were studied to gain a more complete understanding of them.

1. Dissociation pressure measurements were made on the terbium oxides to determine the compositions of the stable oxides between Tb_2O_3 and $TbO_{1.81}$. Measurements of this type had already been made on the praseodymium oxides.

2. X-ray pictures were taken of quenched samples of praseodymium and terbium oxides to determine the structures of the various oxides.

3. High temperature X-ray pictures were taken of these oxides at various temperatures to determine the structures existing under equilibrium conditions. The samples were open to the atmosphere so the pressure was 150 mm of oxygen. The composition of each sample was determined from the dissociation pressure curves.

4. Differential thermal analyses were run as a function of pressure of oxygen. These curves showed the temperature at which oxidations or reductions occurred as the samples of oxides were heated or cooled at a constant rate.

The results on the praseodymium oxides showed the following structures.

Hexagonal: The hexagonal structure is stable under equilibrium at compositions less than $PrO_{1.65}$ at temperatures above 998°C.

Body Centered Cubic: This structure is stable for $PrO_{1.66}$ to $PrO_{1.70}$, in the temperature range 864° to 1050°C and from 100 mm to 550 mm of Oxygen.

Delta: This previously unreported structure is stable from 585°C to 800°C and pressures up to 600 mm. $PrO_{1.71}$ to $PrO_{1.77}$ is the composition range for this structure.

Fluorite: Oxides with an oxygen content from $PrO_{1.78}$ to $PrO_{1.83}$ have this structure. It is in equilibrium at temperatures between 527°C and 400° C and at pressures from 10 mm to 600 mm.

The results on the terbium oxides showed the following structures.

Body Centered Cubic: This structure occurs above 940°C at pressures up to at least 500 mm. Oxides up to $TbO_{1.60}$ have this composition.

Delta: At temperatures from 900°C to 550°C oxides have this structure. The composition is $TbO_{1.71}$ for most pressures up to at least 600 mm.

Fluorite: $TbO_{1.81}$ is stable from 525°C to 400°C and has this structure.

Slow reaction rates were observed for changes in composition. ($TbO_{1.60}$ to $TbO_{1.71}$, $TbO_{1.71}$ to $TbO_{1.81}$).

79 pages. $1.00. MicA54-1361

I. THE SYNTHESIS AND REACTIONS OF o-QUINONEDIBENZIMIDE
II. THE STRUCTURE OF DICHLORODIMETHOXYBENZIDINE-DIBENZENESULFONAMIDE

(Publication No. 7882)

John William Way, Ph.D.
University of Illinois, 1954

Part I

Introduction

The reactions of acylated derivatives of p-quinonediimine have been found to parallel closely those of quinones (1). A recent investigation (2) has shown that substituted o-quinonedibenzenesulfonimides are stable substances, and their reactions with hydrogen chloride have been studied. The unsubstituted member of the series could not be isolated. It was postulated that this was due to polymerization by an intermolecular type of Diels-Alder condensation.

The purpose of this research was to prepare some o-quinonedibenzimides and study some of their reactions.

Discussion of Results

o-Quinonedibenzimide (I), 4-chloro-o-quinonedibenzimide (II), and 4-nitro-o-quinonedibenzimide (III) were prepared by oxidation of the corresponding o-phenylenedibenzamides. Only I and II were obtained as stable, crystalline substances, III was stable only in solution.

Addition of hydrogen chloride to I produced a mixture of monochloro isomers. Treatment of II with hydrogen chloride formed exclusively 3,5-dichloro-o-phenylenedibenzamide (IV). This was proved by unequivocal synthesis of IV and also of 4,5-dichloro-o-phenylenedibenzamide (V). Reaction of III with hydrogen chloride gave 3-chloro-4-nitro-o-phenylenedibenzamide (VI). This structure was determined by conversion of VI to the tribenzamide derivatives (VII) by reduction of the nitro group to the amine and benzoylation. Comparison of VII with the other two unequivocally synthesized isomers showed it to be different.

Acetic acid reacted with I to form 4-acetoxy-o-phenylenedibenzamide (IX). When II reacted with acetic acid, only 4-benzamido-6-chlorobenzoxazole (X) was isolated.

In the presence of boron trifluoride I and II added methanol to form 4-methoxy-o-phenylenedibenzamide (XI) and 4-chloro-x-methoxy-o-phenylendibenzamide (XII) respectively.

Thiophenol and benzenesulfinic acid reacted with I to form products which could not be characterized. However II reacted with thiophenol in the presence of triethylamine to form an adduct which was oxidized by hydrogen peroxide to the same sulfone as that obtained by the addition of benzenesulfinic acid to II.

The active methylene compounds acetylacetone and diethyl malonate were added to I and II in the presence of sodium methoxide to form the corresponding mono adducts. Piperidine readily added to I and II to yield the corresponding substituted dibenzamides. Phenol did not give clear cut products with I or II.

Unrearranged monoadducts were obtained from the reaction of butadiene and cyclopentadiene with I. Cyclopentadiene added to II to form a monoadduct, but butadiene did not react. Maleic anhydride and p-quinone did not form the expected adducts with I, but instead a product (XIII) was isolated from both reactions. A molecular weight determination and analysis of the infrared spectrum led to the identification of XIII as the dimer of I.

BIBLIOGRAPHY

1. R. Adams et. al., J. Am. Chem. Soc., 72, 4601, 5754 (1950); 73, 131, 1149, 1152, 2219 (1951); 74, 2593, 2597, 2603, 2605, 2608, 3029, 3033, 3038, 3657, 3660, 5869, 5872 (1952); 75, 663, 667, 3235, 3403, 3405, 4642 (1953).

2. R. Adams and C. N. Winnick, ibid., 73, 5687 (1951).

Part II

Introduction

A dichloro-3,3′-dimethoxybenzidinedibenzenesulfonamide (I) was prepared by Adams and Holmes (1) from 3,3′-dimethoxydiphenoquinonedibenzenesulfonimide by a series of successive additions of hydrogen chloride and oxidations. 2,2′-Dichloro-5,5′-dimethoxybenzidinedibenzenesulfonamide (II) was shown to be different from I.

The purpose of this research was to establish the structure of I to test a hypothesis previously made (2) that addition of hydrogen chloride to diphenoquinonedibenzenesulfonimides occur by a 1,8-process.

A further purpose was to investigate the reactions of diphenoquinonedibenzenesulfonimide (III) and its 3,3′-dimethyl isomer (IV) with certain reagents that have been observed to add to p-quinonedibenzenesulfonimide.

Discussion of Results

The structure of I was established as 3,3′-dichloro-5,5-dimethoxybenzidinedibenzenesulfonamide (V) by its non-identity to II and 2,2′-dichloro-3,3′-dimethoxybenzidinedibenzenesulfonamide and by the similarity of the infrared spectrum of V to that of N-benzenesulfonyl-2-chloro-6-methoxyaniline.

Acetic acid added to III in the presence of boron trifluoride catalyst to form the acetoxy adduct (VI) which was hydrolyzed to x-hydroxybenzidinedibenzenesulfonamide. Uncharacterized products were isolated from the reaction of acetic acid with IV and from the attempted addition of methanol, thiophenol, benzenesulfinic acid, butadiene and cyclopentadiene to III and IV. 134 pages. $1.68. MicA54-1362

BIBLIOGRAPHY

1. R. Adams, R. R. Holmes and J. W. Way, J. Am. Chem. Soc., 75, 5901 (1953).

2. R. Adams and R. R. Holmes, ibid., 74, 3038 (1952).

CHEMISTRY, ORGANIC

THE COOKING PROCESS: XIII. THE EFFECT OF AQUEOUS SOLUTIONS OF PURE SODIUM HYDROSULFIDE ON THE CONSTITUENTS OF WOOD

(Publication No. 8114)

David Liddell Brink, Ph.D.
University of Minnesota, 1954

Aspen wood was subjected to the action of seven percent solutions of pure sodium hydrosulfide at 180°C for two hours. Seventy percent of chemical, based on the wood, was used.

The reaction mixture was acidified with hydro-

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

chloric acid and extracted with butanol at room temperature to give: (1) residual wood, (2) an aqueous solution and (3) a butanol solution containing the major portion of the solubilized wood constituents.

The butanol soluble products were separated into two fractions based on petroleum ether-butanol solubility. By appropriate distillation and solvent fractionation of the soluble portion, phenol, 2,6-dimethoxyphenol and acetovanillone were isolated and identified. Since phenol had been reported in previous degradative studies on lignin only as a product of pyrolysis and since distillation was a step used in the isolation of these degradation products the origin of phenol as a reaction product was in question. However, it was shown by a second independent procedure for the isolation of reaction products, in which conditions leading to possible pyrolysis were carefully avoided, that phenol was indeed a product occurring in the original reaction mixture and the presence of acetovanillone was confirmed. Furthermore catechol was isolated and positively identified while o-cresol was tentatively identified as reaction products. Catechols with boiling points higher than that of acetovanillone were isolated but positive identifications were not made.

The residual wood, after washing with butanol, appeared to be a brash, unpulped sawdust, thus confirming the fact that sodium hydrosulfide alone is not a pulping agent. However, exhaustive extraction of the acidified reaction mixture with butanol at room temperature left a high yield (53.9%) of completely defibrated, high purity pulp (85% α-cellulose and 0.4% lignin).

Based on the character of the residual wood and the nature of the identifiable low molecular weight degradation products it is proposed that aqueous solutions of pure sodium hydrosulfide, under the conditions noted, are specific agents for the cleavage of protolignin linkages in aspen wood. It is suggested that the explanation of the specificity of reaction under these conditions may be found in the observed development of a high partial pressure of acidic gas (hydrogen sulfide). The presence of excess hydrogen sulfide may be attributed to formation of organic acids from wood and their subsequent reaction with sodium hydrosulfide. Hence the reaction, under the conditions described, appears to occur in a highly buffered system composed of sodium hydrosulfide in equilibrium with an excess of hydrogen sulfide. The particular system is one which is not only conducive to the cleavage of lignin linkages, but since it is a reducing medium it appears that the repolymerization of the cleavage products is minimized.

Further, in consideration of the ionization constants of hydrogen sulfide it is noted that hydrosulfide ion can be present in relatively high concentrations in the pH range of 7-14. Accordingly, it is suggested that the beneficial effect of sulfur in the sulfate process as well as the specificity of sodium hydrosulfide in cleaving lignin linkages may be attributed to a mechanism involving the hydrosulfide ion which is common to both systems. However, in the sulfate pulping process the system may be considered to be buffered with excess sodium hydroxide, and it would be expected that the products formed would undergo repolymerization in the highly alkaline medium. These considerations would explain the absence of simple degradation products as described above in the black liquor from the sulfate pulping process and the relatively low yields of such products found in other studies wherein pure and unmodified sodium hydrosulfide was not the sole component in the initial reaction mixture.

342 pages. $4.28. MicA54-1363

SYNTHESIS OF SOME PYRONE, CHROMONE AND COUMARIN DERIVATIVES

(Publication No. 8162)

Liebe Frank Cavalieri, Ph.D.
University of Pennsylvania, 1945

An improved procedure for the preparation of monoethyl chelidonate and ethyl-pyrone-2-carboxylate is described. The hydrogenation of ethyl -pyrone-2-carboxylate has been studied under various conditions. The principal product obtained in the low pressure catalytic hydrogenation was ethyl 4-hydroxytetrahydropyran-2-carboxylate.

The procedure for the preparation of chromone-2-carboxylic acid has been improved considerably. The latter was onverted to the corresponding acid chloride and by means of the Arndt-Eistert reaction this yielded the diazo ketone. Treatment of the diazo ketone with aqueous hydrobromic acid produced 2-(bromacetyl)chromone. Amino ketones were prepared by condensing either tetrahydroisoquinoline or morpholine with the bromo ketone.

The bromination product of 3-acetylcoumarin was shown by degradation procedures to be 3-(bromacetyl) coumarin rather than the isomeric 4-bromo-3-acetylcoumarin. Both 3-(diethylaminoacetyl) coumarin hydrochloride and 3-(dimethylaminoacetyl)-coumarin hydrochloride were prepared by condensing the proper amines with the bromo ketone. The hydrogenation of the first amino ketone was studied extensively. The formation of Schiff's bases with 3-acetylcoumarin was unsuccessful. The hydrogenation of 3-acetylcoumarin oxime acetate proved to be a very complicated reaction.

70 pages. $1.00. MicA54-1364

OLIGOSACCHARIDE FRAGMENTS FROM OKRA MUCILAGE

(Publication No. 8034)

Harry Edward Conrad, Ph.D.
Purdue University, 1954

Major Professor: Roy L. Whistler

An investigation of the products of partial hydrolysis of okra mucilage has been undertaken to obtain information concerning the structure of this poly-

saccharide. By hydrolyzing a 2% solution of the mucilage for one hour at 80° in 5% sulfuric acid there is obtained in the hydrolyzate a mixture of three galactobioses which have been isolated in pure form using carbon and cellulose chromatography. The galactobiose obtained in largest yield has been crystallized and characterized and has been proved to be 4-O-D-galactopyranosyl-D-galactopyranose.

Using the same hydrolysis conditions for four hours there are obtained from the resulting hydrolyzate an aldobiouronic acid and two aldotriouronic acids. Physical constants for these compounds are recorded and the aldobiouronic acid has been shown to be 2-O-(D-galactopyranosyluronic acid)-L-rhamnopyranose. One of the aldotriouronic acids was shown to be a D-galactopyranosyluronic acid-L-rhamnopyranosyl-D-galactopyranose and the other was shown to be a D-galactopyranosyl-(D-galactopyranosyluronic acid)-L-rhamnopyranose.

Total methylation of the mucilage and quantitative separation of the neutral monosaccharide derivatives obtained upon hydrolysis showed that 2,3,4,6-tetra-O-methyl-D-galactose, 2,3,6-tri-O-methyl-D-galactose, an unidentified tri-O-methyl-D-galactose, and an unidentified di-O-methyl-D-galactose are released in a molar ratio of 7:8:1:1 respectively. Among the hydrolysis products there was also 4-O-methyl-L-rhamnose, but indications are that the total amount of this sugar, which is linked to D-galacturonic acid, was not freed during the hydrolysis.

A structure consistent with all these data is proposed. 44 pages. $1.00. MicA54-1365

A 2-PYRIDINE ANALOG OF CHLOROMYCETIN

(Publication No. 8217)

Robert Edgar Gentry, Jr., Ph.D.
Stanford University, 1954

This thesis reports the synthesis of a 2-pyridine analog of Chloromycetin. This analog is threo-1-(2-pyridyl)-2-dichloroacetamido-1,3-propanediol. Also discussed are some of the reactions of 2-pyridine aldehyde.

2-Pyridine aldehyde was synthesized from 2-picoline by catalytic air oxidation at four-hundred degrees, following the procedure of Mathes and Sauermilch. It was found that 2-pyridine aldehyde would undergo the benzoin condensation catalyzed by the bisulfite ion. This is apparently the first instance in which the bisulfite ion has been used as a catalyst for this reaction. An enediol structure has been assigned to the product obtained from the benzoin condensation of 2-pyridine aldehyde.

2-Pyridine aldehyde was found to condense readily with acetone, acetophenone, p-methoxyacetophenone, nitromethane, and nitroethanol under basic conditions. The products isolated from these condensations depended on the temperature during the reactions. These reactions were not as clean-cut as the corresponding reactions of benzaldehyde; the dilution of the reactants and the order in which the reactants were mixed were important. 2-Pyridine aldehyde was reduced to 2-pyridylcarbinol with sodium borohydride.

2-Pyridine aldehyde was condensed with nitroethanol, the nitrodiol obtained was reduced to the corresponding aminodiol, and this aminodiol, on reaction with methyl dichloroacetate, yielded 1-(2-pyridyl)-2-dichloroacetamido-1,3-propanediol, a 2-pyridine analog of Chloromycetin. On reaction with thionyl chloride at low temperature, this analog yielded a dichloro compound by replacement of the two hydroxyl groups by chlorine. Hydrolysis of the analog with ethanolic hydrogen chloride yielded 1-(2-pyridyl)-2-amino-1,3-propanediol, which, on reaction with methyl dichloroacetate, yielded the original 1-(2-pyridyl)-2-dichloroacetamido-1,3-propanediol. These reactions with thionyl chloride and alcoholic hydrogen chloride indicate that the 1-(2-pyridyl)-2-dichloroacetamido-1,3-propanediol has the threo and not the erythro configuration. The basis for this configurational assignment is discussed in detail. 88 pages. $1.10. MicA54-1366

THE REDUCTIVE COUPLING REACTION AND THE BINARY MIXTURE OF GOMBERG AND BACHMANN

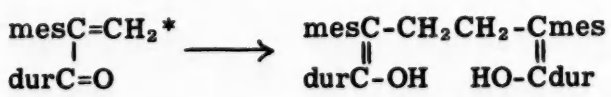
(Publication No. 7850)

Richard Frank Heitmiller, Ph.D.
University of Illinois, 1954

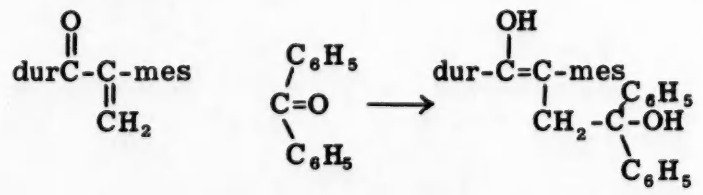
Introduction

The object of this work was to study further the reactions of hindered carbonyl compounds with the binary mixture, Mg-MgI_2, (1) in the hope of extending the scope of the reaction. The following types of reactions were of interest; each type is illustrated here by a specific example.

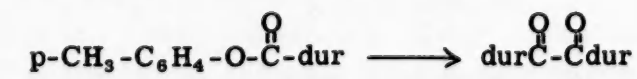
(a) Intermolecular reactions in a 1,4-1,4 manner with a hindered α, β-unsaturated ketone:



(b) Intermolecular reactions in a 1,2-1,4 manner with a hindered α, β-unsaturated ketone and a normal ketone:

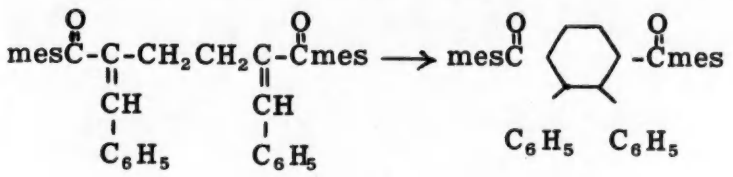


(c) Intermolecular reactions in a 1,2-1,2 manner with esters of hindered acids;



The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

(d) Intramolecular conjugate reductive coupling:



Discussion of Results

Duryl α -mesitylvinyl ketone was found to react with the binary mixture, Mg-MgI_2, to yield a stable dienol, 1,6-diduryl-2,5-dimesityl-1,5-hexadiene-1,6-diol. Oxidation of the dienol produced the corresponding hexadienedione plus some of the original vinyl ketone. Catalytic hydrogenation of the hexadienedione produced the enediol 1,6-diduryl-2,5-dimesityl-1,3,5-hexatriene-1,6-diol (2).

Mesitylvinyl ketone was polymerized when it was allowed to react with the binary mixture, Mg-MgI_2.

Attempts to effect a crossed bimolecular reduction in a 1,2-1,4 manner were unsuccessful.

The dibenzal derivative of 1,4-dimesitoylbutane, prepared by the Claisen method, was found to react with the binary mixture, Mg-MgI_2, to give a compound which is believed to be the cyclohexane derivative that would be formed by reductive conjugate cyclization. Degradation of the compound by attempted catalytic dehydrogenation was found to yield water, mesitylene, mesitoic acid, a hydrocarbon believed to be o-terphenyl, and an unknown aromatic hydrocarbon.

Attempts to effect a similar reduction of the dibenzal derivative of 1,4-dibenzoylbutane were unsuccessful.

The dibenzal derivative of 1,4-dibenzoylbutane could be prepared only by treating the diketone with a large excess of benzaldehyde. The use of smaller amounts of the aldehyde producted a saturated diketone believed to be 1,3-dibenzoyl-2-phenylcyclopentane. Evidence favoring this structure is the fact that the diketone yielded a glycol from which it could be regained by oxidation.

The catechol ester of mesitoic acid was found to react with the binary mixture, Mg-MgI_2, to yield an enediol, dimesitylacetylene glycol, which is oxidized by air to mesitil. The ethylene glycol ester of duroic acid, when allowed to react with the binary mixture, yielded duroic acid.

When a solution of methylmagnesium iodide was added to a solution of p-tolyl duroate, and the mixture was allowed to react, a trace of the reductive coupling product, duril, was isolated. The yield of duril was increased by adding a small amount of anhydrous cobaltous chloride to the reaction mixture.

93 pages. $1.16. MicA54-1367

BIBLIOGRAPHY

1. M. Gomberg and W. E. Bachmann, J. Am. Chem. Soc., 49, 236 (1927).

2. R. C. Fuson and R. F. Heitmiller, ibid., 75, 1494 (1953).

*mes = 2,4,6-trimethylphenyl radical
dur = 2,3,5,6-tetramethylphenyl radical

REACTIONS OF VINYLLITHIUM COMPOUNDS

(Publication No. 7874)

Edwin Charles Steiner, Ph.D.
University of Illinois, 1954

Curtin and Harris[1] have shown that each of the two isomers of 2-(p-chlorophenyl)-1,2-diphenylvinyl bromide reacts sterospecifically with butyllithium and then with carbon dioxide or methanol to give the expected acrylic acid or ethylene having the same steric configuration as that of the starting bromide. The potential usefulness of the reactions of the triarylvinyllithium compounds which are intermediates in the above series of reactions led to their further study in this research.

Triphenylvinyllithium (A) has been shown to react with formaldehyde to give 2,3,3-triphenylpropenol, with benzaldehyde to give 1,2,3,3-tetraphenylpropenol isolated as 1,2,3-triphenylindene, with benzophenone to give pentaphenylpropenol, and with ethyl benzoate or benzoyl chloride to give triphenylvinyl phenyl ketone.

With methyl iodide the lithium reagent (A) reacted to give 1,1,2-triphenylpropene, thus introducing an alkyl group onto a vinyl carbon atom. However, attempts to replace the lithium atom by an aromatic ring were unsuccessful. The lithium reagent from cis-2-(p-chlorophenyl)-1,2-diphenylvinyl bromide was treated with p-chlorobenzenediazonium fluoborate and with 4,4′-dichlorodiphenyliodonium iodide, but the expected 1,2-di-(p-chlorophenyl)-1,2-diphenylethylene could not be isolated.

Each of the lithium reagents obtained from cis- and trans-2-(p-chlorophenyl)-1,2-diphenylvinyl bromide was shown to react stereospecifically with formaldehyde to give a different isomer of 3-(p-chlorophenyl)-2,3-diphenylpropenol, with benzophenone to give a different isomer of 3-(p-chlorophenyl)-1,1,2,3-tetraphenylpropenol, and with methyl iodide to give a different isomer of 1-(p-chlorophenyl)-1,2-ciphenylpropene. The stereoisomeric products obtained were assigned the same configurations as the bromides from which they were derived. This was done by analogy with the findings of Curtin and Harris described above.

In an attempt to confirm the configurational assignments of cis- and trans-3-(p-chlorophenyl)-2,3-diphenylpropenol (cis-B and trans-B), the alcohols were oxidized by means of manganese dioxide to cis- and trans-3-(p-chlorophenyl)-2,3-diphenylpropenol. However, further oxidation of the aldehydes to the known 3-(p-chlorophenyl)-2,3-diphenylacrylic acids by means of silver oxide, potassium permanganate or sodium hydroxide was unsuccessful. A new compound, cis-6-(p-chlorophenyl)-5,6-diphenylhex-5-ene-4-ol-2-one, was isolated as a by-product of the silver oxide oxidation, resulting from the condensation of the aldehyde with acetone.

In an attempt to relate the configurations of the alcohols, cis-B and trans-B, to those of cis- and trans-1-(p-chlorophenyl)-1,2-diphenylpropene, cis- and trans-3-(p-chlorophenyl)-2,3-diphenylpropenyl

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

tosylate were prepared. Their reduction with lithium aluminum hydride, however, did not yield the expected hydrocarbons.

Treatment of cis-B and trans-B with acid resulted in identical mixtures of two new compounds, 6-chloro-2,3-diphenylindene and 3-(p-chlorophenyl)-2-phenylindene. 93 pages. $1.16. MicA54-1368

1. Curtin and Harris, J. Am. Chem. Soc., 73, 2716 (1951).

CHEMISTRY, PHYSICAL

THE ANOMALOUS DIFFUSION OF ORGANIC VAPORS IN HIGH POLYMERS

(Publication No. 8193)

Edward Brownell Bagley, Ph.D.
Cornell University, 1954

The rates of sorption and desorption for the systems acetone-cellulose acetate, methanol-cellulose acetate and acetone-polystyrene at 30.0°C and for acetone-cellulose acetate at 40.1°C have been studied over a series of narrow concentration intervals. It was found that at low initial penetrant concentrations the sorption and desorption kinetics were non-Fickian; the kinetics were not governed by Fick's law (subject to the usual assumption of equilibrium concentration of the penetrant at the film surface) with a diffusion coefficient a function of concentration alone. Above a certain initial penetrant concentration, however, the sorption kinetics showed two distinct phases. There was an initial rapid stage, during which 10-15% of the equilibrium amount for the concentration interval was sorbed. After this initial stage, there was an abrupt decrease in sorption rate, and the attainment of final equilibrium was very slow.

It was shown that the amount of penetrant sorbed in this initial stage establishes a quasi-equilibrium (termed quasi to distinguish from the final, true equilibrium for the concentration interval) throughout the film. Further, the kinetics of sorption in this initial stage were found to be governed by Fick's law with a diffusion coefficient which is a function of the initial penetrant concentration in the film, but not of the size of the concentration interval. The diffusion coefficient in this process was also dependent on the initial orientation of the polymer molecules in the film, but the initial stage apparently does not induce further orientation. The energy of activation for the initial stage process for acetone-cellulose acetate is apparently very low.

The second, or slow stage, was typically anomalous or non-Fickian in nature. When the amount sorbed was plotted against the square root of time, it was found that the initial slope of this second stage was independent of initial penetrant concentration, but was strongly dependent on the size of the concentration interval. This initial slow stage slope was also dependent on molecular orientation of the polymer molecules in the film, and apparently still further orientation was induced during this slow stage.

It is believed that this two stage behaviour is a reflection of the instantaneous and retarded elastic behaviour shown by polymers, such as cellulose acetate and polystyrene at room temperatures. During the initial stage, penetrant enters the film and swells the polymer to its instantaneous elastic limit, at a rate governed by an ordinary diffusion coefficient. During the second or slow stage the kinetics are governed, at least partly, by the polymer relaxation processes associated with the retarded elastic expansion. This results in a time dependent diffusion coefficient. In addition, during the slow stage, the unswollen central core of the polymer film will exert compressive stresses on the outer, swollen sections of the polymer film. This can also lead to a time dependent factor in the second stage diffusion coefficient.

113 pages. $1.41. MicA54-1370

POLAROGRAPHY WITH PLATINUM MICROELECTRODES IN LiCl-KCl AND IN $LiNO_3$ - $NaNO_3$ - KNO_3 MELTS

(Publication No. 8031)

Edward Daniel Black, Ph.D.
Purdue University, 1954

Major Professor: Thomas De Vries

Conditions for the obtaining of polarograms in fused salts with platinum microelectrodes have been investigated and established. Of primary importance in this connection, is the perfection of the platinum to glass seal of the electrodes.

The major portion of this work has been concerned with polarography in the fused eutectic mixture, LiCl - KCl, with the flush platinum microcathode, which consists of a wire sealed in lead glass and cut off even with the glass. A platinum wire spiral was used as anode in these experiments. Temperatures were in the vicinity of 400°C. Automatic recording of polarograms was the general rule although manually obtained polarograms were also studied. Both rotating and stationary electrodes have been effectively employed.

The range of applicability of this polarographic system to reducible substances in fused LiCl - KCl has been found to extend from 0 to approximately -1.5 volts (vs. Pt anode). Reduction waves have been demonstrated and studied for dilute solutions of $NiCl_2$, $CoCl_2$, $CdCl_2$, $PbCl_2$, $ZnCl_2$, $BiCl_3$ and K_2CrO_4. Multiple current steps were obtained for K_2CrO_4 and a mixture of $NiCl_2$ and $CoCl_2$. A geometric

method of analysis was employed to extract values of i_d', $E_{\frac{1}{2}}$ and the decomposition potential, E_D, from the current steps.

Previously reported equations of polarographic waves were shown to apply fairly well in several instances. Thus, for the nickel and cobalt waves a plot of log $(i_d - i)$ vs. $E_{app.}$ gave a straight line of slope close to the theoretical value. For lead polarograms at a fresh platinum surface and for zinc waves, log $(i/i_d - i)$ vs. $E_{app.}$ was a linear relation whose slope was not in agreement with the theoretical value. Thus, for the nickel and cobalt waves at least, it was demonstrated that the currents were essentially diffusion controlled and irreversible effects at the electrode were at a minimum.

Investigations from the analytical viewpoint consisted of demonstrating a linear relation between wave height and mole fraction for $NiCl_2$, $CoCl_2$ and $CdCl_2$ in the general range of mole fraction 8×10^{-5} to 1.2×10^{-3}. In less extensive studies, this linear relation was observed also for the other substances listed above at mole fractions of 1×10^{-4} to 3×10^{-4}. The variation of the wave height of polarograms for $NiCl_2$ was examined with respect to the following variables: polarization rate, speed of rotation of the microcathode, area of the cathode, and temperature. Also, the dependence of the slope, $\Delta i/\Delta E$, of the current plateau on the above factors was studied. On the basis of these investigations it was possible to define some optimum experimental conditions for particular applications of polarography in fused LiCl - KCl.

The expected linear relation between $E_{\frac{1}{2}}$ and logarithm of concentration (mole fraction) for polarographic reductions at a platinum microelectrode was observed for nickel and cobalt waves. Observed and calculated values of the slope of these lines were in fair agreement. The decomposition potential, E_D, for $NiCl_2$ and $CoCl_2$ varied with mole fraction in a manner fairly well described by the familiar Nernst relation for electrode potentials, i.e. E_D vs. log N was a straight line of a slope near the theoretical value. An electromotive series of half-wave potentials at 407°C (in volts vs. the Pt anode and in the order of increasing ease of reduction) was found to be: $ZnCl_2$, -1.40; $CdCl_2$, -1.18; $PbCl_2$, -1.01; $CoCl_2$, -0.90; $Cr^{+3} \rightarrow Cr^{+2}$ (from K_2CrO_4), -0.84; $NiCl_2$, -0.70; $BiCl_3$, -0.41; $Cr^{+6} \rightarrow Cr^{+3}$ (K_2CrO_4), -0.30. These potentials were determined at a mole fraction of reducible species of $(1.2 \pm 0.1) \times 10^{-4}$ in each case. The effects of temperature and polarization rate on E_D and $E_{\frac{1}{2}}$ for $NiCl_2$ and $CoCl_2$ were found to be so small as to be negligible for most practical purposes.

Extensive studies of the effect of temperature on polarograms of $NiCl_2$ resulted in an empirical, linear relation between log i_d and $1/T^0$ K. The energy of activation for the diffusion current was determined from the slopes of these lines to be 4.7 ± 0.5 kcals. In the interval 380° - 450°C the average temperature coefficient provides further evidence that diffusion and not the rate of reaction is the controlling factor in the polarographic waves of nickel.

Another fused salt solvent examined was the eutectic mixture $LiNO_3$ - $NaNO_3$ - KNO_3 at 190°C. Polarograms for dilute solutions of $CuSo_4$ in this melt were obtained at rotating, spherical, platinum and silver microelectrodes. The anode in these experiments was a Ag/AgCl electrode. Small amounts of potassium chloride were added to the melt to provide chloride ion for the anode. A linear relation between wave height and concentration of $CuSO_4$ was observed.

Time vs. current studies at a constant applied potential were unsuccessful in both fused salt media because of the disturbing effect of thermal convection and density gradients on the diffusion layer at the electrode. Attempts to extend fused salt polarography to a molten, equal mole per cent mixture of NaCl - KCl at 700°C have not as yet been successful. The principal difficulty has been the lack of good platinum to glass seals for this high temperature.

194 pages. $2.43. MicA54-1371

DETECTION OF FREE RADICALS FROM THE HETEROGENEOUS DECOMPOSITION OF BUTANE BY A TRACER TECHNIQUE

(Publication No. 7787)

Sydney Winn Fleming, Ph.D.
University of Pennsylvania, 1954

Supervisor: Dr. K. A. Krieger

Although free radicals have frequently been postulated as intermediates in catalytic and thermal decompositions of hydrocarbons, there is virtually no direct evidence for their occurrence in such processes. This study was undertaken to provide a means of detecting radicals produced by the decomposition of normal butane over hot wire catalysts of aluminum (oxide) and tungsten under conditions which would not allow secondary or complicating reactions to occur.

A mirror of radioactive iodine was formed on the walls of the reaction chamber at low temperatures to serve as a trap for free radicals by reaction to form alkyl iodides, and the butane pressure was kept low enough so that the mean free path of gas molecules was greater than the diameter of the reaction chamber. Each free radical reacted with iodine on collision with the wall, effectively removing it and preventing secondary reactions in the gas phase. The products of this reaction were mixed with carrier alkyl iodides at the end of the run, the excess free iodine removed, and the mixture fractionally distilled. The activities of various fractions gave the relative quantities of the corresponding free radicals formed in the decomposition of butane.

The conclusions which have been drawn from the data may be summarized as follows:

(1) The method used has been shown to be capable of detecting free radicals in the gas phase.

(2) No free radicals were detected using platinum filaments in the temperature range of 400°-1300°C.

(3) Aluminum (surface slightly oxidized) filaments produced methyl radicals almost exclusively at 300°, normal butyl radicals at 430°, and secondary butyl plus ethyl at 540°.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

(4) Tungsten filaments produced ethyl radicals at 800° and both ethyl and secondary butyl radicals at higher temperatures.

(5) Very low efficiencies for the production of radicals were observed, on the order of 1 in 10^6 collisions. The evidence is insufficient to determine whether this was due to a very small degree of decomposition, or to the failure of radicals to escape from the surface of the filaments.

62 pages. $1.00. MicA54-1372

THE PHOTO-FISSION OF HEAVY ELEMENTS

(Publication No. 7844)

James Edward Gindler, Ph.D.
University of Illinois, 1954

The photo-fission cross sections of some heavy elements have been measured for bremsstrahlung having maximum energies from 125 to 300 Mev. A scintillation counter was used to determine the fission recoil fragments. The yield in terms of fissions $/\frac{erg}{cm^2}/$ atom found for 276 Mev maximum energy bremsstrahlung were

Ta	0.33	0.04×10^{-24}
W	0.59	0.07×10^{-24}
Re	1.18	0.16×10^{-24}
Os	0.61	0.06×10^{-24}
Ir	2.68	0.23×10^{-24}
Pt	1.21	0.12×10^{-24}
Au	1.20	0.09×10^{-24}
Hg	1.68	0.10×10^{-24}
Tl	1.63	0.15×10^{-24}
Pb	2.46	0.20×10^{-24}
Bi	5.38	0.23×10^{-24}
Th	236	5×10^{-24}
U-235	1135	12×10^{-24}
U-238	560	7×10^{-24}

The errors shown above represent the standard deviation due to counting. Cross sections have been calculated from these data. For bismuth and elements of lower Z the cross sections rise rapidly with energy above 125 Mev reaching a value of about 9 millibarns for bismuth and about 6 millibarns for lead at 300 Mev. On the basis of these cross sections and data on the fission branching ratios from charged particle reactions, the photon absorption cross section has been shown to be of the order of 50 millibarns. The cross sections for uranium and thorium are subject to large errors because of unknown contributions made by bremsstrahlung between 30 and 100 Mev. 132 pages. $1.65. MicA54-1373

A NEW MILLICOULOMETER FOR THE STUDY OF THE POLAROGRAPHIC REDUCTION OF ORGANIC COMPOUNDS

(Publication No. 8046)

James Lee Kroon, Ph.D.
Purdue University, 1954

Major Professor: Thomas De Vries

The new millicoulometer developed consisted of a dropping mercury electrode immersed in a cadmium ion solution, the latter in a micro cell. The volume (0.1-0.4 ml.) of the solution was small enough so that after current had passed through it for a period of time (100-200 min.), the wave height of the cadmium ion had decreased significantly. Upon correlating the change in wave height with the volume of the solution and the initial concentration of the cadmium ion, the amount of current that had passed was calculated. By connecting a second dropping mercury electrode and micro cell containing a solution of a reducible substance in series with it, data was obtained from which the polarographic $\bar{n}$-value (no. of Faradays per mole) of the second substance was calculated.

This method of determining $\bar{n}$ was tested by employing reducible substances of known $\bar{n}$-values in the second cell. Two inorganic and two organic species were used: cadmium ion, thallium ion, fumaric acid and p-nitrobenzoic acid. The following individual $\bar{n}$-values were obtained: cadmium ion 1.88, 1.94, 2.02, 2.04 and 2.08, thallium ion 1.00, 1.00, 1.03, 1.05 and 1.06, fumaric acid 1.94, 1.98, 2.02 and 2.08, p-nitrobenzoic acid 3.92, 3.96, 4.22 and 4.22. The average n-value for each given species is within two per cent of the true value.

Application of the method to 2,2-dinitropropane in a nearly 50-50 alcohol-water mixture containing 0.10 M lithium chloride, 0.08 M citric acid and 0.08 M sodium citrate yielded the $\bar{n}$-values 1.36, 1.41, 1.44 and 1.82. When the Stokes-Einstein and the Lingane-Leveridge equations were employed, $\bar{n}$ was found to be 3.07. When the conductivity at infinite dilution of the dimethylmalonate ion (a similar species) was used in conjunction with the Lingane-Loveridge equation, $\bar{n}$ was found to be 4.18. In the light of the normal $\bar{n}$-value of four accepted for mononitro compounds, the result obtained from conductivity data appears more logical.

The reduction of saccharin in 0.08 M potassium chloride and 0.075 M hydrochloric acid with 0.005 per cent gelatin produced the $\bar{n}$-values 3.84, 3.86, 3.96 and 4.00. The average, 3.92, is within two per cent of the integral number 4.0, which is thus the true value.

The fourth and final wave of the multi-step reduction curve of tetraiodophthalic anhydride was found to represent an electron change of 8. The four separate runs gave 7.70, 7.74, 8.12 and 8.44. The medium was 0.16M sodium carbonate, 0.16M potassium chloride, and 0.05 M potassium iodide with 20 per cent dimethylformamide.

The reduction of p-phenoxybenzophenone was completed in a 58.1-41.9 mixture by volume of ethanol

and water, 0.10 M lithium chloride, 0.10 M sodium acetate with 0.0025 per cent gelatin (pH 8.3). All of the n-values were fractional, 1.28, 1.30, 1.60, 1.64, 1.66, 1.70 and 1.80 and therefore suggestive of a mixed reduction product. This conclusion agrees with the results obtained by Pasternak in the controlled potential reduction of the similar species, benzophenone, from which resulted the alcohol and the pinacol.

Listed below for the above compounds in the following order are:

$$E_{\frac{1}{2}} \text{ vs Ag / AgCl, } \frac{i_d}{C\, m^{\frac{2}{3}}\, t^{\frac{1}{6}}}, \frac{i_d}{C\, m^{\frac{2}{3}}\, t^{\frac{1}{6}}\,(1 + 39D^{\frac{1}{2}}t^{\frac{1}{6}}/m^{\frac{1}{3}})},$$

D x 10^5 (Ilkovic), D x 10^5 (Lingane-Loveridge), D x 10^5 (Stokes-Einstein). 2,2-Dinitropropane: 0.580, 3.24, 3.10, 0.178, 0.163, 0.270. Saccharin: 1.166, 5.35, 4.97, 0.485, 0.421, 0.716. Tetraiodophthalic anhydride: 1.12 (Ag / AgI), 9.06, 8.19, 0.348, 0.310, 0.360. p-Phenoxybenzophenone: 1.46, ---, ---, ---, ---, 0.210. The wave height versus concentration plot for p-phenoxybenzophenone was not linear over the whole concentration range yet apparently the reduction was diffusion controlled. The Stokes-Einstein and the Eyring equations are unsatisfactory for calculating polarographic diffusion coefficients. 143 pages. $1.79. MicA54-1374

THE MECHANISM OF THE REACTION BETWEEN NITROSYL CHLORIDE AND OZONE

(Publication No. 8220)

Frederick Leighton, Jr., Ph.D.
Stanford University, 1954

The reaction between nitrosyl chloride and ozone was first studied by Schumacher and Sprenger for the purpose of producing nitryl chloride. They described the reaction as "rapid and complete":

$$NOCl + O_3 \longrightarrow NO_2Cl + O_2$$

Because this reaction could be considered an analog of the reaction between nitrogen dioxide and ozone, the present investigation was undertaken.

The disappearance of nitrosyl chloride was followed by the absorption of the 405 mμ line of mercury; the reaction cell was a one meter-long Pyrex tube, and the transmitted light was measured by a photomultiplier tube, the output of which was impressed on a vacuum tube voltmeter.

The initial part of this investigation gave results which were not reproducible and which indicated that the reaction was possibly heterogeneous. The disappearance of nitrosyl chloride followed a characteristic pattern, in that the reaction started slowly, increased in rate for part of the run, and then decreased and fell to zero as the reactants were used up. After careful repurification of the reactants to be certain that all impurities had been removed, and after replacement of the reaction cell by one with a smaller surface to volume ratio, the reaction was slowed down considerably, and in many cases there was no evidence of any reaction taking place. As before, the results were not reproducible.

The impurity most likely to be present in an ozone-oxygen mixture produced by passing oxygen through a silent electric discharge is nitrogen pentoxide derived from nitrogen present in the original oxygen. Also, the dissociation of nitrosyl chloride produces nitric oxide which in the presence of ozone is rapidly oxidized to nitrogen pentoxide. Small quantities of nitrogen pentoxide were added to the reaction mixture to determine the effect of this most probable impurity. This procedure resulted in a fast homogeneous reaction whose stoichiometric equation was identical with that for the reaction between nitrosyl chloride and ozone alone.

The rate of this reaction, which included nitrogen pentoxide as a catalyst, was found to be one-half order with respect to nitrosyl chloride in the presence of a large excess of ozone. After correcting for the nitrosyl chloride dependence, the rate was found to be one-half order in ozone. Then by making several runs with varying quantities of nitrogen pentoxide, the dependence of the rate on nitrogen pentoxide was determined. The plot of the logarithm of the rate constants of all runs calculated on the basis that the reaction was one-half order in both nitrosyl chloride and ozone, against the logarithm of the nitrogen pentoxide concentration, indicated that the rate showed a one-half order dependence on nitrogen pentoxide. The empirical rate expression thus obtained was

$$\frac{-d(NOCl)}{dt} = k(NOCl)^{\frac{1}{2}}(O_3)^{\frac{1}{2}}(N_2O_5)^{\frac{1}{2}}$$

Reasoning from the mechanism given previously for the nitrogen pentoxide catalyzed decomposition of ozone, the following mechanism was proposed for this reaction:

$$N_2O_5 \xrightarrow{k_1} NO_2 + NO_3$$

$$NO_2 + NO_3 \xrightarrow{k_2} N_2O_5$$

$$NO_2 + O_3 \xrightarrow{k_3} NO_3 + O_2$$

$$NOCl + NO_3 \xrightarrow{k_5} NO_2Cl + NO_2$$

Assumption of steady state conditions for nitrogen trioxide and nitrogen dioxide lead to the rate expression derived from this mechanism:

$$\frac{-d(NOCl)}{dt} = \left\{\frac{k_1 k_3 k_5}{k_2}\right\}^{\frac{1}{2}} (NOCl)^{\frac{1}{2}}(O_3)^{\frac{1}{2}}(N_2O_5)^{\frac{1}{2}}$$

which is the same as the rate expression obtained experimentally. Values of k_1/k_2 and k_3 are known, and from these and the observed rate constant, the value of k_5 was found to be 0.69×10^8 c.c.mole^{-1} sec.$^{-1}$ Assuming a value of the pre-exponential factor of 10^{12} c.c.mole^{-1} sec.$^{-1}$, the energy of activation of k_5 is predicted to be 6 kilocalories.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

The conclusion reached regarding the work of Schumacher and Sprenger was that their reactants probably contained nitrogen pentoxide. The erratic results of the first part of the present investigation may likewise be due to nitrogen pentoxide produced by the dissociation of initially pure nitrosyl chloride into nitric oxide and chlorine, with subsequent oxidation of nitric oxide by ozone to nitrogen pentoxide.

53 pages. $1.00. MicA54-1375

STUDIES ON HYDROGEN CHLORIDE. I. THE EXCHANGE REACTION BETWEEN TRITIUM HYDRIDE AND HYDROGEN CHLORIDE IN A GLOW DISCHARGE. II. RED HYDROGEN CHLORIDE: AN IMPURITY COLOR CENTER.

(Publication No. 8052)

Robert Eliot Martin, Ph.D.
Purdue University, 1954

Major Professor: W. H. Johnston

Part I

In 1938 Cross and Leighton reported an exchange reaction between hydrogen and hydrogen chloride under the influence of 2100 A radiation using deuterium and a gas density balance to measure the exchange.

The present research is a further study of this exchange reaction using tritium as a tracer and initiating exchange by an electric glow discharge. It also reports the absence of thermal exchange at room temperature in Pyrex and the discovery of a first order isotopic exchange under the influence of a glow discharge. Experimental data is presented which indicates that this reaction is heterogeneous.

A theoretical discussion is given which includes a critical analysis of previous quantum yield calculations in terms of the modern theory of exchange reactions, a review of the exchange studies on H_2 D_2, and a derivation of a long list of kinetics for the possible mechanisms of exchange between TH and HCl. This treatment includes a discussion of the isotope effect.

In the experimental work an historical and experimental survey is given of the methods of determination of tritium. Gas counting is emphasized and it is demonstrated that butane-helium-hydrogen is a self-quenching Geiger counter filling. The memory effect in brass counters is examined and explained in terms of adsorption phenomena.

First order exchange laws are obtained at several pressures with half-times from 7.9 to 38 minutes at one-fortieth to one-twentieth atmosphere pressure with 360 and 1400 amperages and voltages, respectively. The variation of actual exchange rate independent of isotopic change with surface area indicates a heterogeneous reaction. A comparison of the experimental order with respect to HCl with a series of Freundlich approximations of the Langmuir-Hinshelwood treatment of surface reaction indicates that the slow step is a heterogeneous reaction between H and HCl.

In this treatment, approximate expressions are given for the dependence of the dissociation of the HCl by the glow discharge upon the pressure of the HCl. Finally the experimental absence of an isotope effect tends to confirm the selection of the slow step.

Part II

In connection with exchange studies using hydrogen chloride, a red color was observed in samples of anhydrous hydrogen chloride which was frozen quickly with liquid nitrogen. This research is a detailed search for the explanation of this phenomenon and consists of five types of studies.

A mass spectrometer was modified to receive hydrogen chloride and was used in an unsuccessful search for an ordinary impurity. A systematic series of addition experiments were done with trace amounts of H_2, H, N_2, Cl_2, Cl, CO_2, NO_2, O_2, ClO_2, He, and NO. It was found that as little as 10^{-5} mole fraction of the NO, alone, was able to produce the red coloration. In thermodynamic measurements a rate of heating apparatus was designed and built to measure the relationship between red hydrogen chloride and the transition temperature of -175° C between the two modifications of HCl. It was found that the color, developed at -195° C, disappears at this transition temperature. In optical studies a Beckman Spectrophotometer was used to measure the spectral transmission of red HCl at -195°C. A primary absorption peak occurs at 3350 Å wavelength. Secondary peaks occur on the long wavelength side at 4700 and 5000 Å. In lattice defect experiments unsuccessful attempts were made to color white HCl by high intensity x-radiation and to measure the electrical conductivity of red HCl.

It is proposed that the red color is due to lattice color centers in the low temperature form of solid hydrogen chloride. The imperfections of the lattice are trapped molecules of nitric oxide in which the odd electron of this molecule can undergo optical transitions in the field of the hydrogen chloride lattice. This phenomenon may be called an impurity color center. The nature of this color center and the dielectric constant of the low temperature form of solid HCl suggest that this form has considerable ionic character. This suggestion is discussed in detail. It is further proposed that the impurity color center of red HCl is most closely related to the F center. Insertion of the experimental data of the primary peak in Smakula's equation for the number of F - centers agrees with the preparation with NO. If the primary absorption peak of red HCl is added to the usual straight line plot of the peaks of the F - centers of the alkali chlorides, red HCl fits on this line.

172 pages. $2.15. MicA54-1376

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

YIELDS AND EXCITATION CURVES FOR SOME HIGH ENERGY PHOTO-SPALLATION REACTIONS OF COBALT

(Publication No. 8202)

Robert Leslie Wolke, Ph.D.
Cornell University, 1954

Samples of cobalt acetate were bombarded with bremsstrahlung from the 300 Mev synchrotron. Radiochemical separations were carried out on the exposed samples and the separated fractions were counted to determine the yields of several spallation products. The yields of some of the reactions were measured as a function of bremsstrahlung energy.

The following processes were investigated: $Co^{59}(\gamma,p5n)Fe^{53}$; $Co^{59}(\gamma,p6n)Fe^{52}$; $Co^{59}(\gamma,2pn)Mn^{56}$; $Co^{59}(\gamma,2p5n)Mn^{52}$; $Co^{59}(\gamma,2p6n)Mn^{51}$; $Co^{59}(\gamma,3p7n)Cr^{49}$; $Co^{59}(\gamma,4p8n)V^{47}$; and $Co^{59}(\gamma,5p9n)Ti^{45}$. The yields and average deviations of these reactions with 309 Mev bremsstrahlung were found to be 7.36±1.59, 0.457±0.010, 20.5±1.7, 27.2 (6.0-day isomer only), 8.30±0.55, 4.83±0.06, 3.23±0.12, and 3.64±0.02, respectively, in units of

$$\int_0^{W_{max}} \frac{\sigma(W)\, I(W)\, dW}{10^{-29} Q} \ (cm^2),$$

where $\sigma(W)$ is the cross section as a function of energy, $I(W)dW$ is the number of photons with energy between W and W + dW, and Q is the number of effective photons. For those reactions in which two or more protons are emitted, there is a general decrease of yield with increasing number of ejected nucleons.

The $Co^{59}(\gamma,2pn)Mn^{56}$, $Co^{59}(\gamma,2p6n)Mn^{51}$, and $Co^{59}(\gamma,3p7n)Cr^{49}$ reaction yields were measured also at bremsstrahlung energies of 261, 216, and 174 Mev. The $(\gamma,2pn)$ process shows little if any variation of yield with photon energy above 174 Mev and is therefore shown to be initiated largely by photons below this energy. The $(\gamma,2p6n)$ and $(\gamma,3p7n)$ measurements indicate that photons above 174 Mev are effective; the former reaction cross section seems still to be rising rapidly at 309 Mev, while the latter has levelled off. The existence of a maximum in the yield of the $(\gamma,3p7n)$ process between 200 and 300 Mev is indicated, but doubtful.

The combined yield of the $(\gamma,2p6n)$ and $(\gamma,3p7n)$ reactions is in general agreement with the results of photographic emulsion studies, showing a decrease of about 40% from 309 to 174 Mev.

75 pages. $1.00. MicA54-1377

ECONOMICS, GENERAL

ECONOMIC FACTORS IN MIGRATION TO ST. PAUL, MINNESOTA, 1940-1950

(Publication No. 8111)

Maurice Charles Benewitz, Ph.D.
University of Minnesota, 1954

Labor economists maintain that given some wage and, thus, income differential, job opportunities rather than wage changes motivate geographical migration. James S. Duesenberry explains rural-urban migration this way in a recent progress theory. Job-motivated migration, he contends, will supply sufficient labor to an area to permit industrial expansion for some period without labor cost increases.

This thesis tests the hypothesis that migration is job-motivated rather than wage-motivated and an alternative hypothesis that rural-urban migration is job-motivated while interurban migration is both job- and wage-motivated. Furthermore, skills of migrants are compared with skills of urban workers, because a continuing rural-urban differential is assumed in these theories. This differential can best be explained if rural migrants are workers of low productivity and skills as compared to urban workers.

The alternative hypothesis mentioned above implies that sufficient labor is not usually attracted to expanding industries by up-grading available labor and by hiring rural migrants. Some interurban migrants must be attracted by income increases.

The data used to test these hypotheses describe the employment experience of a 2% sample of the population of St. Paul, Minnesota, 14 years or older. The Bureau of the Census drew this sample in February, 1951, for the United States Department of the Air Force and the Social Science Research Council. A work history was taken from those persons 25 or older who had worked full-time one month or more during 1950. Histories of males who migrated to St. Paul since January, 1940, are used in this study. Characteristics of the migrant group are compared with those of the St. Paul male population as reported in a University of Minnesota Industrial Relations Center study based on the whole sample.

Multiple regressions are calculated for migration into St. Paul, job opportunities, and changes in wage differentials. Regressions are computed for total migration into St. Paul, 1940-1950, and for rural-urban migration into St. Paul, 1940-1950. Change in St. Paul total employment measures job opportunity. A wage differential is computed by subtracting West North Central Region farm daily rates without board from a daily wage for Swift and Company common labor in South St. Paul. No relationship appears between either job opportunity or wage differential and migration. This finding does not support the job-motivated migration hypothesis.

A significant percentage of interurban migrants

had larger incomes after migration to St. Paul than before. (Significance is established by Chi Square testing.) This finding supports the hypothesis that interurban migrants are motivated by income change as well as by job opportunity.

Difference between skill distributions of migrants and of the St. Paul population are tested for significance by use of Chi Square tests. All migrants were not significantly less skilled immediately after movement than was the St. Paul male population. Interurban migrants are significantly more skilled than the native population; rural migrants are significantly less skilled. However, skills used in industrial occupations are not found to be less frequent among rural migrants than in the native population.

These skill findings support neither the job-motivation theory of migration nor the theory that rural migration is job-motivated while interurban migration is job- and income-motivated. For either theory to the skills of rural migrants must be low.

On the basis of the data for St. Paul between 1940 and 1950, neither job opportunity nor wage changes can be accepted as an explanation of the male migration which occurred.

122 pages. $1.53. MicA54-1378

THE AWARDS OF THE NATIONAL RAILROAD ADJUSTMENT BOARD

(Publication No. 7555)

Chi-Ta Chen, Ph.D.
State University of Iowa, 1954

Chairman: Professor Walter L. Daykin

The development of railway labor legislation has been a slow process or one that has been evolutionary in nature. It is mainly a regulatory function which is imposed by the Federal Government as permitted indirectly by the principles of American constitutional law. The enactment of the Railway Labor Act of 1926 represented the joint thinking of railway carriers and unions. The Act in the beginning rested upon (1) the protection of the right of railway workers to organize and bargain collectively through representatives of their own choosing; and (2) the prevention of the interruption of interstate commerce. In the 1934 amendments four other important considerations were added to the earlier objectives. These are (1) the strengthening of the right of employees to organize for the purpose of collective bargaining without any interference or coercion; (2) the consideration of the problem of settling disputes by separating the mediatory function from the judicial process, which would encourage resort to arbitration; (3) the providing of techniques for handling serious "emergency" strikes; (4) the establishment of the national Railroad Adjustment Board.

The National Railroad Adjustment Board is the latest legislative machinery established by the Congress of the United States to assist in the settlement of railway labor disputes. This machinery provides unions and management with an orderly procedure in the settlement of disputes.

The purpose of this study is, first, to examine briefly the history of railroad labor relations since 1888 with particular emphasis on the Railway Labor Act of 1926 and its amendments; second, to analyze the existing grievance machinery of the Amended Railway Labor Act of 1934 as to its structure and function; third, to show the present status of industrial relations in the railroad industry with reference to awards; fourth, to point out the defects of the existing grievance procedure and to suggest changes in the Amended Railway Labor Act of 1934, which is now in effect.

This study deals mainly with the achievements of the National Railroad Adjustment Board. In scope this study encompasses: (1) the methods and procedures for the settlement of labor disputes in the railroad industry that have been involved in various previous statutes passed by Congress; (2) the underlying philosophy or principles that have developed from the working of these statutes; (3) the court and administrative rulings that have been involved in the interpretation of jurisdiction and grievance procedures of the National Railroad Adjustment Board; (4) the economic reasoning and problems involved in the interpretation or application of the working rules in the railroad industry; and (5) the Awards of the Board.

It has been thought best to limit the study to the quantitative achievements of the National Railroad Adjustment Board since such an analysis would indicate the effectiveness of the existing grievance machinery. No attempt has been made to give any detailed analysis of the qualitative achievements of awards. Since there are approximately 33,698 cases that have been disposed of by various divisions of the Board, a complete survey is obviously beyond the scope of this study. However, some important and meaningful awards will be discussed to supply illustrations showing the jurisdiction and the nature of the working rules involved in the Board's work.

322 pages. $4.03. MicA54-1379

SHARES OF THE UPPER INCOME GROUPS IN INCOME BY STATES, 1919, 1929, 1933 AND 1937

(Publication No. 8160)

Hyman Menduke, Ph.D.
University of Pennsylvania, 1952

Supervisor: Simon S. Kuznets

From data available in Statistics of Income for 1919, 1929, 1933 and 1937 estimates were made of the number of individuals represented in Federal tax returns for each state, as well as their income, excluding capital gains and permitting only business expenses as deductions. The percentages of total income payments to individuals in each state received by given proportions of the total state population were computed. Data were available for the top 1/2 per cent and the second 1/2 per cent of the state population for

all 48 states in each of the four years. The shares received by the 2nd and 3rd percentage band were computed for 38 states, the shares received by the 4th and 5th percentage band were computed for 24 states and the shares received by the 6th and 7th percentage band were computed for 13 states.

The ranks of the states in income shares received by the upper income groups remained fairly constant from 1919 to 1937. Hence much of the analysis was restricted to state averages over the period for each percentage band and each cumulative group. For the cumulative groups, the average state income shares were highest in the Northeast, followed by the Southeast, the Middle States, the Southwest, the Far West and, lowest of all, the Northwest. In considering the average income shares received by successive bands, certain regional shifts were observed. At every percentage band, the state income shares received by the upper income groups in the Northwest remained consistently very low as compared with other regions. As lower percentage bands were considered, the ranks of the Northeastern and Middle States declined while those of the Southern and Far Western States rose.

Ranks in the average state income shares received by cumulative groups and successive bands were correlated with state ranks in: size of the state, as measured by total population; proportion of state income composed of interest and dividends; relative differential between per capita income of nonfarm and farm population; relative size of nonfarm and farm population; relative differential between per capita income of White and Negro population; relative size of White and Negro population; degree of concentration of population in large urban centers; proportion of population composed of professional and business men. These variables went far in explaining state differences in inequality of income.

It was expected that the mean of the state shares received by the upper income groups would be smaller than that for the country as a whole. This was confirmed, the weighted mean of the state income shares received by the top 1 per cent being, for every year, lower than the corresponding countrywide figure.

The composition, by state of residence, of the countrywide upper income groups was analyzed for 1929. It was found that the Northeast and Far West as a whole were "over-represented", the Middle States received roughly a "proportionate" representation and the Southeast, Southwest and Northwest were considerably "under-represented".

The state income shares received by the top 1/2 per cent showed an upward secular movement from 1919 to 1937 for the majority of states. For lower percentage bands, few states showed evidence of any secular movements. The most pronounced secular changes were largely explained on the basis of changes in the same variables that were mentioned earlier.

Changes in state shares of the upper income groups during the 1929-37 reference cycle were studied. Direct conformity with the reference cycle was observed for those state percentage bands in which per capita incomes were very high; inverse conformity was observed for those state percentage bands in which per capita incomes were somewhat lower. 149 pages. $1.86. MicA54-1380

LINEAR PROGRAMMING AS A POSSIBLE REFINEMENT OF FARM BUDGETING TECHNIQUES

(Publication No. 8139)

Niels Rorholm, Ph.D.
University of Minnesota, 1954

The objective of this thesis has been to investigate whether linear programming provides a worth while refinement of budgeting analysis in the determination of optimum farm organizations.

The method of budgeting and that of linear programming are similar in terms of data required, and the calculations of basic input-output data. After that point, however, linear programming substitutes an algebraic analysis for the trial and error method of the budgeting technique.

The method of linear programming is first developed here by means of a simple hypothetical example which is solved graphically as well as by way of a tabular arrangement. The tabular analysis which is used is the "simplex" method developed by George A. Dantzig. It is a simple iterative method which is well suited to manipulations by clerical workers and to adaptation for digital computers.

After the method of linear programming has been developed it is applied to a problem in farm organization which utilizes average data for a group of southern Minnesota farms. Subsequent to the determination of the optimum farm organization for that set of data, some of the assumptions of linear programming are relaxed and possible extensions of the method are discussed.

The assumptions of linear programming in its simplest form are the following: (1) Linear homogeneity; it is assumed that the farmer operates under conditions of constant proportions in certain areas, and constant returns to scale over the full range of production possibilities. (2) Additivity; it is assumed that the productivity of any enterprise is unaffected by its combination with any other enterprise. (3) Divisibility; it is assumed that enterprises and resources are perfectly divisible within the farm business. (4) Finiteness; it is assumed that the farmer has only a finite number of production possibilities available to him. (5) Limited availability of resources; it is assumed that some limitations exist on the amounts of resources which the farmer can obtain for production purposes.

It is concluded that linear programming has definite possibilities as a useful tool in the determination of optimum farm organizations. Some of its advantages are: (1) The process of linear programming guarantees an optimal solution for a given set of data and assumptions. (2) It limits the area of personal judgment to the pre-solution stage, thus making sure

that the solution which evolves is logically consistent with the data and assumptions used. (3) The linear programming solution contains information which will aid in the evaluation of alternative programs, and from which the stability of the solution and the productivities of some inputs can be determined.

Some disadvantages may be: (1) The input-output data when only rough approximations may yield meaningless results when inserted in a rigid linear programming framework. (2) Many research workers may find it necessary to spend a considerable amount of time studying linear programming before attempting its application. (3) The automatic solutions process may be a disadvantage unless the researcher possesses considerable knowledge of production relationships in the field to which linear programming is applied. 90 pages. $1.13. MicA54-1381

ECONOMIC ASPECTS OF OLD-AGE ASSISTANCE IN THE STATE OF OHIO

(Publication No. 7879)

Karl Frederick Treckel, Ph.D.
University of Illinois, 1954

The purpose of this study is to describe the economic impact of old-age assistance on the Ohio economy under both State and State-Federal sponsorship and to offer suggestions as to how old-age assistance may be improved on state and national levels. Wherever possible statistical data obtained from Ohio's Division of Aid for the Aged were utilized along with information obtained from state and county welfare officials and recipients of assistance by means of personal interviews.

In this study the author shows that within a period of fifteen years old-age assistance and Old-Age and Survivors Insurance were responsible for the closing of seven of Ohio's county homes thereby realizing one of the original objectives of both Ohio's old-age assistance law and the Social Security Act. Cash awards have made it possible for former and potential inmates of such institutions to obtain other living accommodations better suited to their needs. Additional closings appear imminent.

Although there has been a steady decline in OAA caseloads since 1941 as more people have become eligible for OASI benefits, this study shows that decreasing caseloads have been more than offset by increases in the size of awards. Maximum grants have been increased on six occasions (from $30 to $65 per month) thus leading to increased gross expenditures. Because the formula for computing OASI benefits remained static during the period of from 1939 to 1950 even though the Consumer Price Index advanced 72.5 percent, Ohio's OAA recipients fared much better than the state's OASI beneficiaries prior to December, 1952.

Although variations exist among Ohio's eighty-eight counties with respect to the size of average assistance awards, far greater economic significance must be attached to variations in the extent of old-age dependency in Ohio's counties. Four criteria of analysis (average income, degree of urbanization, location, and importance of manufacturing) were utilized by the writer to explain caseload variations on the county level. Ohio ranks low (35th) among the states with respect to the number of OAA recipients per 1,000 aged persons but individual Ohio counties find themselves abreast of the nation's poorest states with respect to old-age dependency. On the basis of economic conditions in Ohio's poorer counties the author concludes that OAA will continue to play an important role in the State's economy even in the wake of extended OASI coverage.

In order that many deserving but legally ineligible persons 65 years of age and over may qualify for assistance the writer recommends that Ohio abandon its citizenship and residence requirements as prerequisites to receiving aid. Such changes are in keeping with suggestions made by the Social Security Administration and would result in reduced expenditures by Ohio for General Assistance which is financed entirely out of state funds.

Inasmuch as uniformly applied Federal matching formulas fail to evaluate the needs and fiscal capacities of poor states to finance assistance programs the writer recommends that variable grants be made available to the states on the basis of per capita incomes. Such grants have long been used successfully by Ohio and most of our states in dealing with inter-county economic differentials.

Although the costs incurred in maintaining old-age assistance programs will in a large measure be affected by our concepts of need, varying economic conditions that characterize the states, county differentials within states, and the particular specifications and methods chosen to finance public assistance programs, old-age assistance will by its contribution to the economic well-being of our aged population and to our national welfare more than pay for itself just as it has in the past. 361 pages. $4.51. MicA54-1382

ECONOMICS, AGRICULTURE

FACTORS AFFECTING CONSUMER PURCHASES OF FRYING CHICKENS

(Publication No. 7872)

Raymond Claris Smith, Ph.D.
University of Illinois, 1954

The objective of this study is to determine the factors which affect consumer purchases of frying chickens.

During 1951, consumers purchased more beef than any other meat from two large retail chain firms in the Philadelphia-Wilmington area. Poultry sales were second and equaled almost one-third of total meat sales. Fryers made up the greatest volume of poultry sales.

A comparison of weekly farm, wholesale, and retail prices of fryers indicates that all followed essentially the same pattern. Approximately 48 percent of the variance in retail prices and 81 percent of the variance in wholesale prices were associated with variance in farm prices.

For the year 1951, approximately 41 percent of the variance in volume of purchases of fryers by consumers from a large retail chain firm may be attributed to variance in price of fryers.

Fryer sales tended to form a pattern opposite that of pork loin. Variance in volume of fryer sales was associated with 38 percent of the variance in pork loin sales. This would tend to indicate there may be a certain amount of substitution between the two.

The relationship between volume of sales of fryers and of beef was positive and was low.

Approximately 63 percent of the variance in weekly volume of sales of fryers for one large chain firm may be attributed to variance in prices of fryers, stewers, pork loin, veal, and lamb.

A New York dressed fryer usually retailed for less money than did the same fryer prepared ready-to-cook or as cut-up parts. Retail stores often do not make an additional charge for eviscerating a New York dressed dryer. However, if a ready-to-cook fryer is placed in the display case the price includes a charge for evisceration. This practice tends to retard the shift from the sale of New York dressed to ready-to-cook fryers.

In 1951 the cost per serving of fryers was lower than for any other meat studied. This may account for the relatively high consumption of fryers.

A sample of housewives in Wilmington were asked a number of questions pertaining to their consumption of chicken. The majority of housewives served chicken either weekly or every two weeks. Low income families tended to serve chicken more frequently than those with high incomes.

After examining a portable exhibit of ten New York dressed fryers, housewives indicated they would purchase the birds in the following order if all were sold at the same price per pound: (1) grade A in all respects, (2) grade A except feed in crop, (3) grade A except broken bone, (4) grade A except skin tears, (5) grade A except pin feathers, (6) grade A except poor finish, (7) grade A except abrasions, (8) grade A except poor fleshing, (9) grade A except bruises, and (10) grade A except poor bleeding.

170 pages. $2.13. MicA54-1383

ECONOMICS, COMMERCE - BUSINESS

LOCAL AND FEEDER AIRLINES AND PUBLIC POLICY

(Publication No. 7887)

Paul David Zook, Ph.D.
University of Illinois, 1954

The Civil Aeronautics Board gave its approval to the experiment in local and feeder air transportation in 1945. The program, which has continued to the present, has involved the extension of the air network to smaller communities of the nation not receiving service by the truck lines. It has been an attempt to test the air traffic potential of these points to determine the extent to which air service to them is warranted.

This thesis has attempted to evaluate the legislative and regulatory policies which have been applied to the experiment. This necessarily required an examination of the Civil Aeronautics Act of 1938 which provided the legal basis for the experiment as well as the legislative framework for its regulation. The Act provided for the regulation of commercial air transportation by the Civil Aeronautics Board. An evaluation of regulatory policy has, therefore, required an examination of the Board's actions as they have been applied to the local service lines.

The legislation and regulation of the experiment has been evaluated in the light of sound public policy. While United States history reveals numerous examples of public subsidies granted to aid a developing form of transport, sound public policy requires that the subsidized agency must move toward self-sufficiency. An exception to this exists where the transportation produces non-economic benefits, e.g., greater national security or improved postal service.

While an examination of the record of the local and feeder experiment reveals some reduction in relative reliance on government financial support, it also shows a high, an probably increasing, absolute reliance on this source of funds. It seems probable that given the present equipment available to the local airlines and their route structures, self-sufficiency is doubtful.

It seems unlikely at present that the aircraft industry will produce the plane which is required for the local lines to achieve independence from mail subsidy. If this is true, the self-sufficiency which sound public policy requires can be gained only by a rearrangement of routes. It is not expected here that the airlines will initiate the action which will produce the essential redrawing of the air network under the present policies of the Board. Neither is it expected that the Board will be willing to formulate and compel acceptance of its own plans for a subsidy-free route structure.

It is suggested that the Board modify its mail pay policy to achieve the desired end. This could be done by the announcement of a program for a scheduled withdrawal of subsidies gradually over a period of years. It is hoped this would have the effect of inducing the local and feeder airlines to explore the possibilities of a realignment of existing routes so that self-sufficiency could be achieved.

282 pages. $3.53. MicA54-1384

EDUCATION, GENERAL

CONSTRUCTION AND APPRAISAL OF PROCEDURES AND MATERIALS FOR DEVELOPING CONSENSUS REGARDING MUSIC EDUCATION PROGRAMS

(Publication No. 7839)

James Wayne Davidson, Ed. D.
University of Illinois, 1954

Statements by general educators and music educators and findings of research studies give support to the generalization that the music education programs of our public schools are in need of improvement.

It is believed that curriculum improvement will be most effective if it is accomplished in accordance with democratic principles.

Effective group process is seen as a necessity in democratic curriculum development, for only as groups are able to work together successfully can democratic curriculum development become a reality.

Unfortunately, there is reason to believe that members of the teaching profession generally do not possess the knowledge or skills needed to facilitate successful group action.

Schools interested in improving their music education program could possibly avoid this difficulty by engaging a consultant whose knowledge of group dynamics could be utilized to instruct local groups in the techniques of working together successfully.

In view of the large number of schools interested in curriculum revision, it would appear to be highly improbable that a sufficient number of consultants will soon be available to aid in curriculum improvement.

The problem of this study is to attempt to devise instruments and procedures which give promise of affording reasonably adequate substitutes for the services of a consultant in democratic curriculum development. Accordingly, three instruments in the form of inventories, together with related procedures, have been devised. Labeled A, B, and C, these inventories are designed for use by local school groups in conducting curriculum improvement projects in music education.

Inventory A, entitled "What Do You Think About Our School's Music Education Program?", contains statements of twenty-three objectives of music education which are believed to be valid for public schools. The completion of this inventory by each member of the group conducting this study constitutes the initial step in the evaluation of their school's music program.

The results of Inventory A are used as the basis for a series of group discussions aimed at achieving consensus regarding (1) the objectives proposed in Inventory A, (2) the importance of the proposed objectives, and (3) the extent to which the proposed objectives are being accomplished in the local school.

Upon completion of discussion meetings, Inventory B, entitled "In What Respects Should We Strengthen Our School's Music Education Program?", is used to determine the extent of consensus achieved as well as to identify those areas of the school's music education program which the group believes to be in need of improvement.

When those areas have been determined, the local leader appoints a planning committee to work out a detailed plan for the accomplishment of desired improvements.

Inventory C, entitled "What Should We Do To Strengthen Our School's Music Education Program?", has been designed for the use of the planning committee. It contains detailed suggestions for the accomplishment of each objective stated in Inventory A. These suggestions are intended largely as guides, since local conditions must be the deciding factor.

The planning committee should work out a detailed plan for accomplishing desired improvements and submit it to the group for approval. After approval by the group and the Board of Education, the local administrative head of the school should assume responsibility for putting the approved plan into effect.

All steps in the development of the inventories were appraised by a jury composed of general educators, music educators, and representatives of interested professional organizations.

The procedures by which these three instruments are to be used can be demonstrated (1) to afford reasonably adequate substitutes for all the principle services ordinarily performed by a competent consultant and (2) to give promise of facilitating all but one of the principles of effective group process.

224 pages. $2.80. MicA54-1385

MINNESOTA MULTIPHASIC PERSONALITY INVENTORY RESULTS FOR HIGH SCHOOL DROP-OUTS AND GRADUATES

(Publication No. 8138)

Fred Paul Roessel, Ph. D.
University of Minnesota, 1954

Procedures

This study was directed towards determining differences between drop-outs and graduates on certain factors. Hathaway and Monachesi administered the Minnesota Multiphasic Personality Inventory to pupils in the ninth grade in the Minneapolis Public

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Schools in the spring of 1948. In June 1951, 2835 of these individuals graduated from high school. In the intervening time 421 left the schools because of transfers. The group of 763 who had left the schools without indicating a desire for further education along with one-third of the graduates were the subjects of special study.

Drop-outs were classified by grade level of withdrawal and by sex. Graduates also were classified on basis of sex. The following information was obtained for each graduate and each drop-out:

1. Standard score on ten scales of the MMPI, namely Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Masculinity-feminity, Paranoia, Psychasthenia, Schizophrenia, Hypomania, and Introversion-Extroversion.
2. Honor point average.
3. Intelligence quotient.
4. Number of children in family.
5. Number of grades repeated.

Data were transferred to Hollerith cards and with appropriate machines the following measures were obtained:

1. Means, standard deviations, and standard errors of means for each sub-group and each major group.
2. Differences between means and Student's "t".
3. Significance level of each difference.
4. Mean MMPI score by interval of IQ, HPA, and number of children in family and by number of grades repeated, respectively.

Data obtained from Steps 1, 2 and 3 were presented in tabular form, from Step 4 were graphed.

Conclusions

Some important conclusions can be drawn from the tabular data:

1. On nine of ten MMPI scales drop-outs were significantly more abnormal than graduates. The one test that did not yield significant results was the Masculinity-feminity variable.
2. When grade level of withdrawal was considered, pupils whose MMPI scores were higher tended to withdraw from a lower grade. Tenth grade drop-outs were more abnormal on the MMPI than eleventh or twelfth grade drop-outs.
3. The HPA, IQ, and number of children in families of drop-outs were significantly higher than for graduates. All apparent differences were larger for tenth grade than for eleventh and twelfth grade withdrawals.
4. Drop-outs and graduates who had not repeated a grade were significantly different on all measurements, except Mf. Drop-outs and graduates who had repeated a grade or more were significantly different only on HPA and number of children in their families.
5. When graduates who had repeated were compared with graduates who had not repeated, differences were all significant except Mf. Internal comparisons for drop-outs yielded similar results.

Graphic data indicated strong associations between trends in MMPI mean scores and other factors under study. The more important results may be summarized:

1. As HPA was increased by intervals, mean scores on the scales for Psychopathic Deviate, Schizophrenia, and Hypomania, for graduates and drop-outs decreased sharply. When IQ was increased by intervals, only mean scores for graduates decreased sharply. Mean scores for drop-outs on these tests tended to remain high or to decrease slightly. This indicates that pupils with high IQ's and low scores on these tests tended to be graduated; pupils with high IQ's and high scores tended not to be graduated.
2. Only graduates with high IQ's and graduates with high HPA's tended to score as did groups upon which MMPI was standardized.
3. As number of children in families of drop-outs and graduates were increased, mean MMPI scores tended to increase. Drop-outs tended to score higher than graduates in each interval.

This study strongly indicates that drop-outs and graduates tend to be different in significant ways. If schools are to be adjusted to hold more pupils in school longer, these differences must be recognized as determinants in curricular planning.

296 pages. $3.70. MicA54-1386

EDUCATION, ADMINISTRATION

THE JOB OF THE ELEMENTARY SCHOOL PRINCIPAL AS VIEWED BY PARENTS

(Publication No. 8203)

Reed Lawrence Buffington, Ed. D.
Stanford University, 1954

The Problem

For some time there has been widespread concern with the problem of selecting and training school administrators. One of the initial tasks in approaching a solution to these problems is the identification of the job of school administrators. A review of the literature reveals that many have sought to describe the jobs; however, their efforts have resulted in general statements of needed abilities and skills which are not very well suited to the needs of those who would devise programs of selection and training.

This Study

As a part of the larger effort to precisely and meaningfully identify the jobs of school administrators, this study is to report what is perceived by parents to be the job of the elementary school principal in Oakland, California.[1] It is an effort to describe in behavioral terms what is judged by parents to be effective or ineffective behavior on the part of the elementary school principal through reports of incidents in which the interviewee was of the opinion that the action of the principal or the situation was especially important.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

The Research Design

The device used to obtain the data was the critical incident technique developed by Flanagan at the American Institute for Research.[2] The technique is used in an attempt to arrive at a description of those aspects of the job which are critical for success or failure. It involves securing reports from persons associated with the subject concerning actual important happenings in which, in the judgment of the interviewee, the behavior of the subject was either effective or ineffective. These reports are then subjected to a process known as "category formulation." This is the general process by which the data are analyzed in order to arrive at critical requirements for the job. The term "category formulation" is descriptive of the process which involves gathering behaviors and formulating descriptive requirements representing these groups. Herein, then, consists the statement of critical requirements for the job in terms of behavior.

Permission was obtained from the administration of the Oakland Public School District to carry out this study in that city. From among the sixty-three elementary schools in Oakland, thirty were selected at random and permission for the study obtained from the principal. Three parents from each of the selected schools were selected at random and interviewed individually. From the 90 interviews, 294 incidents were obtained. From the 294 incidents, 436 behaviors were extracted. Anonymity was assured for the participants.

Findings

An analysis of the reported incidents through the process of "category formulation" indicated the following major categories and subcategories:

I. DEVELOPING RELATIONSHIPS WITH PARENTS' GROUPS AND THE COMMUNITY
   - A. Organizing and Implementing Parents' Groups
   - B. Interpreting the School to the Community
   - C. Working with Parents' Groups

II. WORKING WITH AND CARING FOR CHILDREN
   - A. Maintaining Discipline
   - B. Showing Personal Interest in Children
   - C. Protecting Health and Safety of Children
   - D. Working with Atypical Children

III. KNOWING AND HELPING PARENTS
   - A. Meeting Parents' Complaints
   - B. Establishing Friendly Relations with Parents
   - C. Reporting to Parents on Progress of Children

During the entire process of category formulation, the refinement of the data and the writing of statements to cover similar behaviors was checked by the writer of the companion study.

Recommendation

Experience with this study seems to indicate that consideration should be given to further studies of the job of the elementary school principal involving the use of the critical incident technique.

There are at least two possibilities for further study. One would be that of using the same technique to obtain perceptions from parents in other communities of varying size and location. A second would be to obtain the views of other reference groups such as supervisors, administrative superiors, students, school board members, civic leaders, and teachers.

101 pages. $1.26. MicA54-1387

1. cf. Leland L. Medsker, "The Job of the Elementary School Principal as Viewed by Teachers" (Unpublished Doctoral dissertation, Leland Stanford University, 1954).

2. John C. Flanagan, et al., Critical Requirements For Research Personnel: A Study of Observed Behaviors of Personnel in Research Laboratories (Pittsburgh, Pennsylvania: American Institute for Research, 1949).

A STUDY OF ADMINISTRATIVE AND GUIDANCE PRACTICES FOR STUDENTS FROM ABROAD IN REPRESENTATIVE COLLEGIATE INSTITUTIONS OF THE UNITED STATES

(Publication No. 8167)

Edward Charnwood Cieslak, Ed.D.
Wayne University, 1954

This study has tried to show that notwithstanding the goodwill clearly evident in connection with accepting students from abroad for study in American collegiate institutions, the increasing numbers of foreign students that have been coming to the United States (in absolute numbers and in distribution) have sharpened the problems of organization, administration, objectives, and counseling attendant upon their presence in American colleges and universities.

These problems, further, have been complicated by two major factors: (1) the historic institutional autonomy of American colleges and universities has resulted in widely divergent policies and practice in respect to foreign students; and (2) the relatively recent interest of the Federal Government in utilizing the exchange of persons as an instrument toward furthering foreign policy objectives has introduced for students and institutions alike a new motive in cross-cultural contacts different from the traditional ones.

Faith in the values mutually derived by the presence of foreign students in American colleges and universities has only infrequently been subjected to critical examination. Previous studies and reports are agreed that there is a remarkable paucity of research in this area of concern – of evaluative studies that could suggest improvements and refinements, or give standards and norms in order that the international interchange of students be made more effective and constructive.

Hence, this survey was designed to ascertain the prevailing problems and policies in respect to foreign students in America from the point of view of

collegiate institutions and from that of the students themselves. Separate questionnaires were prepared and forwarded to 200 colleges and universities and 800 foreign students in the spring of 1952. Returns were received from 122 schools (61 per cent), and from 354 (44 per cent) students.

In order that a degree of perspective be had in dealing with the current problems of foreign students, Chapter II is devoted to "The Historical Background of Cross-Cultural Contacts on the Student Level." Therein is shown that contacts between diverse peoples and races have been an integral part of the life of man since the dawn of history.

Problems in the selection and admission of foreign students, as well as collegiate practices in the evaluation of foreign school credentials, are discussed in Chapter III.

Finally, the practices of colleges and universities in the orientation and counseling of students from abroad are described. The discussion here is concerned with such topics as administrative organization, qualifications of a foreign student adviser, academic and vocational counseling, orientation, ascertaining proficiency in English, housing, health problems, immigration regulations, the academic performance of international students, and social interrelationships.

CONCLUSIONS AND RECOMMENDATIONS

1. There appears to be need for a clarification of objectives in terms of cross-cultural contacts on the student level – especially so in those cases where the foreign policy objectives of the United States Government are involved. Where objectives are at variance with the traditional motives of university study, the wiser course is to channel sponsored persons into non-collegiate programs.

2. There is real need for greater coordination and direction of community groups and resources as they relate to foreign students. Perhaps an area council composed of interested individuals, private agencies, and collegiate institutions could serve in this connection.

3. While standardization in the evaluation of foreign school credentials and the reporting of such evaluations by means of college transcripts probably cannot be achieved, there is, nonetheless, great need for more uniformity in evaluations and inter-institutional reporting.

4. There is need, finally, for a realistic appraisal of the effects of an education in America after foreign students return home. Research along these lines could serve not only to clarify our procedures, but also, perhaps, show the need to make more flexible college degree requirements where possible to fit students' objectives.

391 pages. $4.89. MicA54-1388

THE APPLICATION OF THE GEOGRAPHIC METHOD TO SCHOOL DISTRICT REORGANIZATION IN UNION COUNTY, ILLINOIS

(Publication No. 7857)

Walter Hastings McDonald, Ph. D.
University of Illinois, 1954

The application of the geographic method to planning is not new as it has been used in federal, regional and urban planning. The purpose of this paper is to show the usefulness of the geographic method in the field of educational planning – specifically the determination of the ideal type of administrative district and the location of the accompanying attendance centers.

The method used consisted of selecting a sample area, applying the geographic method to the analysis of factors affecting school reorganization, and then proposing a new plan for the sample area. Union County, Illinois was selected as the sample area because it possesses a variety of factors important to school reorganization.

The geographic analysis considered five topics deemed important to school reorganization. These were: (1) the present situation in school system patterns and their origin; (2) the natural setting of the planning area; (3) the population characteristics; (4) basis and distribution of economic wealth with emphasis on assessed valuation, and (5) the conditions and patterns of the road system as it might affect the development of school bus routes. Each of these was investigated by personal survey, library research and interviews where needed information could be obtained in this manner. The data was organized and analyzed and the resulting information is presented by numerous maps, pictures, tables and graphs, as well as in text.

The geographic study of Union County, Illinois revealed a long record of consolidation but too many one-teacher, one-room rural schools still remain. A portion of the county – the Dissected Bluff landform region – offers a major challenge to planning because of its sparse and scattered population, its high amount of tax exempt land owned by the state and federal governments and the few roads which cross this area of steep slopes. The population is generally decreasing for the county as a whole, while within the county there is a well developed rural to urban movement. Since local taxation is important to school revenue this will in time lead to less money available in rural areas, areas which even now are unable to present an adequate school program. The road system of the county is adequate for larger school districts.

On the basis of the above planning data, it is concluded that Union County, Illinois needs a new school plan. Such a plan should be based upon all factors which in any way may affect school reorganization. The county has two choices – a county unit district, or community unit districts. Since one community unit district is now in existence involving parts of three counties, and since this district is separated from the remainder of the county by the semi-barrier

Dissected Bluff landform region, it is recommended that a new community unit comprising all of the county exclusive of the present community unit district be developed. This minimizes the disadvantages of the Dissected Bluff landform region because children will be transported out of the area in two directions and not across it. The larger tax base will decrease the disadvantages of the low rural assessed valuation, it will provide for the differences in population densities and will give a flexibility so needed for a county undergoing steady changes.

Since the thesis is written in the field of geography and is intended to be used in educational planning, three appendices are included. Their purpose is to explain the meaning and purpose of geography and geographical research.

91 pages. $1.14. MicA54-1390

THE JOB OF THE ELEMENTARY SCHOOL PRINCIPAL AS VIEWED BY TEACHERS

(Publication No. 8205)

Leland Leon Medsker, Ed. D.
Stanford University, 1954

Introduction

The problem of identifying the essential characteristics of the job of the school administrator is receiving widespread attention. Such information is sought as an aid in the selection and training of administrators as well as to give guidance to those in administrative positions. While there have been numerous studies revealing the general characteristics and duties of administrators, few attempts have been made to describe the job of the administrator in behavioral terms. It is this kind of description with which this study was concerned.

The Study

Specifically, the study sought to identify critical behaviors for one type of school administrator in one school system – that of the elementary school principal in Oakland, California. By use of the critical incident technique developed by Flanagan at the American Institute for Research,[1] observations of teachers concerning the behavior of the principals were gathered and analyzed.[2] After obtaining administrative permission to work in the Oakland schools, thirty of the sixty-three elementary schools in the city school system were selected at random to participate in the study. Three teachers from each of the schools were then selected at random and interviewed individually. Each was asked to relate his or her observations of the actions of a principal in an important situation and to indicate whether or not in the teacher's opinion the behavior of the principal in the given situation was effective or ineffective. Assurance was given the teachers that complete anonymity would prevail in the study.

From the ninety interviews, 402 incidents were obtained, and from these incidents, 569 separate behaviors were extracted. Through a process known as "category formulation" the behaviors were gathered into categories representing a group of similar behaviors and descriptive statements written for each category. To further group the behaviors, subcategories were set up under each category and definitions likewise written for each subarea.

Findings

The categories thus obtained were:

I. PROVIDING LEADERSHIP FOR TEACHERS
   - A. Building Teacher Morale and Unity
   - B. Evaluating and Giving Help to Teachers
   - C. Sharing Decisions and Responsibilities with Teachers
   - D. Providing for Control of Faculty
   - E. Planning and Utilizing Faculty Meetings

II. WORKING WITH AND CARING FOR CHILDREN
   - A. Maintaining Discipline
   - B. Showing Personal Interest in Children
   - C. Making Special Provisions for Atypical Children

III. MAINTAINING RELATIONS WITH THE COMMUNITY
   - A. Coping with Parental Pressures
   - B. Encouraging and Promoting Parents' Groups

IV. ADMINISTERING THE SCHOOL
   - A. Establishing Administrative Devices and Procedures
   - B. Meeting Emergencies at School

V. WORKING WITH INDIVIDUAL PARENTS
   - A. Handling of Irate Parents
   - B. Gathering Facts Before Making Decisions

During the entire process of category formulation and the refinement of the data, the judgments of the writer were checked with the writer of the companion study.

Recommendation

Experience with this study seems to indicate that consideration should be given to further studies of the job of the elementary school principal involving the use of the critical incident technique. It is recognized that the reference group used in this study is only one of many which should be considered in attempting to approach a more complete understanding of the job.

There are at least two possibilities for further study. One would be that of using the same technique to obtain perceptions from elementary school teachers in other communities of varying size and location. A second would be to obtain the views of other reference groups such as supervisors, administrative superiors, students, school board members, civic leaders, and parents.

110 pages. $1.38. MicA54-1391

1. John C. Flanagan, et al., Critical Requirements for Research Personnel: A Study of Observed Behaviors of Personnel in Research Laboratories

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

(Pittsburgh, Pennsylvania: American Institute for Research, 1949).

2. cf. Reed L. Buffington, "The Job of the Elementary School Principal as Viewed by Parents" (Unpublished Doctoral Dissertation, Leland Stanford University, 1954).

THE ADMINISTRATIVE ACTIVITIES AND PRACTICES OF TWENTY IOWA COUNTY SUPERINTENDENTS

(Publication No. 7570)

N. LeRoy Nelson, Ph. D.
State University of Iowa, 1954

Chairman: Assoc. Prof. Dan H. Cooper

The purpose of this study was to determine what are the administrative activities and practices of twenty Iowa county superintendents of schools and to investigate the possibility of relationship between the quality of administrative work of these superintendents and the following factors: (1) method of selection for office, (2) extent of professional training, (3) extent of professional experience, and (4) amount of financial support for the superintendent's office.

The collection, treatment, and presentation of data were organized about eight commonly recognized areas of administrative work and relationships.

The statutes were examined to determine the legally prescribed duties and responsibilities of the Iowa county superintendent.

Twenty superintendents reported in personal tape-recorded interviews their professional activities and practices for the period of 1948-1951. A detailed analysis and classification was made to ascertain the general pattern of work. Examples of adaptive, coordinative, and innovative activities and practices were selected for detailed description.

Summaries of the reported activities and practices of each superintendent within twenty-five subareas of six general areas of administration were made and submitted to a group of other Iowa county superintendents to be rated on a five-point scale as to quality of administration. From these ratings, converted to sigma equivalents, a score was obtained for each superintendent in each of the six areas of administration.

Relationship between a selected factor (characteristic) and quality of administration was tested by comparing mean scores of two groups of superintendents selected on the basis of the extent of their possession of the characteristic (i.e., ten with the most, ten with the least). A t-test of significance was applied, with the null hypothesis rejected at the 2 per cent level.

The majority of the eighty-four duties and responsibilities given in the statutes are concerned with the superintendent's (1) giving advice and making recommendations to local school boards, (2) collecting and compiling information for the state, and (3) serving as a means of communication between the local districts and the state. In few instances does he have any power or authority to direct personnel, to decide issues, or to determine policy or procedure.

The reported activities and practices were varied. Many were of a pedestrian nature. Most were concerned with the rural one-room schools within the County School System, indicating comparatively few administrative relationships existing with the schools outside the County School System. Increased educational services by the state have increased the work load of the superintendents. Their main efforts seemed to be directed toward (1) supervision of the teaching personnel, (2) administration of the educational program, and (3) acting as an advisor at the request of the local school boards.

Superintendents appointed in 1948, or later, generally rated higher in quality of administration than those who had come into office by election before 1948. The only true difference found in this comparison was in the administration of teaching personnel, favoring the elected group.

Those with the most professional training generally rated higher than those with the least, with a true difference only in the administration of pupil personnel. Those with the most training in school administration generally rated higher, but no true difference existed. Those with the most training in improvement of instruction also tended to rate higher, with a true difference existing in the administration of business affairs.

Those with the most professional experience generally rated higher, with a true difference in the administration of teaching personnel. Those with the most administrative experience rated lower in all six areas, but no true difference existed.

The ten receiving the least financial support per pupil tended to rate higher, but no true difference was found. 381 pages. $4.76. MicA54-1392

A PLAN FOR EDUCATIONAL DEVELOPMENT IN A CALIFORNIA COMMUNITY

(Publication No. 8206)

Howard Mortvedt Nicholson, Ed. D.
Stanford University, 1954

The Board of Education of the Santa Cruz City School System received a report on April 28, 1953 from a structural engineering firm to the effect that four school buildings in this system did not meet the construction requirements authorized by Sections 18191-18205 of the California Education Code, and thus, could not be considered safe for occupancy in the advent of an earthquake. In accordance with Sections 18223-18235 of the California Education Code, the Board of Education closed the buildings reported to be of sub-standard construction.

This resulted in 42 classrooms being taken out of operation in the school system. Twenty-six of these rooms were at the high school, and 16 rooms were in one of the elementary school buildings. Approximately 1600 students in grades K-12, were directly

affected by this action. For the remainder of the 1952-53 school year, these children were placed on a double-shift basis.

The purpose of this study was to form a plan of action to: (1) ameliorate the schoolhousing problems in this school system, and (2) guide the Board of Education in making sound decisions for the years ahead. The study was further limited to the following administrative areas of concern:

1. The formation and function of a citizens committee.
2. The formulation of a master building plan for the next seven years.
3. Recommendations for the financing of the master building plan.

The method used in this study is action research. Basic data were gathered by the interview method, examination of school system records, and from personnel of various community agencies. Another source was the literature in which recommended practices have been established. Several guides were formed for the study from data found in the literature and with the guidance of various personnel of the School of Education at Stanford University.

The contents of this dissertation, by chapters, are as follow:

Chapter I.	Problem and Method of the Study
Chapter II.	The Santa Cruz Citizens Committee for School Problems
Chapter III.	Population Trends of the United States and California as Related to Santa Cruz
Chapter IV.	Classroom Needs
Chapter V.	Site Recommendations for Santa Cruz City Schools
Chapter VI.	Suggested Maintenance and Operations Policies for the Santa Cruz City Schools
Chapter VII.	Financing Current Operations and Capital Outlay Requirements
Chapter VIII.	Summary and Implications

Solutions to the specific problems encountered in the Santa Cruz City School System have been included in various chapters of this dissertation. While this study has been particularily concerned with one school system, it provides a procedure and method that may be used to arrive at solutions to similar problems in other school systems throughout California. In addition to the procedure and method, several general conclusions that pertain to all school systems have been drawn from this study and are presented in Chapter VIII.

214 pages. $2.68. MicA54-1393

ADMINISTRATION OF SPECIAL SERVICES IN COMMUNITY SCHOOLS: A STUDY OF FACTORS RELATED TO COMMUNITY UNIT SUPERINTENDENTS' CONCEPTS OF ADMINISTRATION OF SELECTED SPECIAL SERVICES AND AN INVESTIGATION OF THE ADMINISTRATIVE STRUCTURE FOR THEIR PROVISION

(Publication No. 7865)

Donald Mattison Prince, Ed.D.
University of Illinois, 1954

The purpose of this study has been (1) to discover what underlies the differences of opinion of local community unit district superintendents regarding the assignment of direct administrative responsibility for special services that are so strongly advocated by a few national leaders as prime responsibilities of the intermediate unit district, and (2) to discover in the light of these findings new insights which will contribute to a better organization and administration of the seven special services being studied. These services were education of the handicapped (excluding speech correction), speech correction), special guidance services, special health services, special library services, adult education, and transportation.

New local districts reorganized on larger community lines – such as the community unit district in Illinois – are thought to be more adequate in terms of providing all the necessary educational services most effectively and economically. There is evidence, however, that many of the potential advancements have not materialized. Professional literature shows an abundance of expressions favoring provision of certain services through an intermediate type of district, such as the county superintendency in Illinois. A study by Professor W. P. McLure[1] shows that superintendents in newly reorganized community unit districts are not in agreement concerning proper locus of administrative responsibility for some services. The seven services selected for the present study were most problematical in this respect.

Ten representatively selected community unit districts were chosen as cases for intensive study. The superintendents of these districts were interviewed through means of an "open-end" type of personal Interview Guide. Interview material was recorded in full, and conclusions were based on analyses of the data.

Factors which were found to be related to local superintendent's concept of the administration of special services are: (1) financial condition of the district, (2) pupil population of the district, (3) community lag in the concepts of education, (4) type of leadership by the county superintendent, (5) ambiguity or conflict of educational theory, and (6) developmental stage of local superintendent's thinking. It is not assumed that these six factors are all inclusive, nor is the relationship necessarily causal in nature.

From the standpoint of the second purpose, some of the important problems and trends noted are:

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

1. Community unit districts are organizing without an adequate financial base.
2. County superintendents are not always accepting the new leadership role possible with the advent or reorganization.
3. A serious problem exists in some districts in which there is no "community" within the unit district.
4. Retarding to the development of enriched programs is the lack of public understanding of opportunities available with reorganization.
5. There is a noticeable movement toward wider lay participation in the planning of educational programs.
6. Library facilities and speech correction are currently receiving emphasis in the developing program.

Major implications which can be projected from the findings of this study are as follows:

1. The factors found to be related to community unit superintendents' administrative concepts emphasize the point that further study of the development of educational programs in Illinois must be socio-psychological and economic as well as educational in nature.
2. A decided unawareness of need on the part of lay people is an observed fact which the writer believes should receive prior consideration at this stage of development of district reorganization.
3. District reorganization has re-emphasized the importance of in-service education of professional educators.
4. Professional educators need to clarify their thinking as to the nature and purpose of the special services being investigated in this study.
5. Increased lay participation in the development of educational goals in community unit districts is imperative.

The present study has intended to contribute to a store of basic information from which more advanced studies may be made.

144 pages. $1.80. MicA54-1394

1. For a preliminary report see William P. McLure, The Role of the Intermediate Type of County Superintendency, Urbana, Illinois: Bureau of Educational Research, University of Illinois, 1952 (mimeographed).

PERCEIVED HOSTILITY IN ADMINISTRATOR-TEACHER RELATIONSHIPS

(Publication No. 8207)

Murray Ellis Shipnuck, Ed. D.
Stanford University, 1954

The study analyzed hostility exhibited in the behavior of elementary school principals as this hostility was perceived by the principals in themselves, as it was perceived by their teachers, and the relationships of these perceptions of hostility to the degree of faculty morale that existed in the schools. The elementary school principal was viewed as playing a crucial role in influencing faculty morale, and it was assumed that the interpersonal relations conducive to morale would be impaired if the teachers perceived hostility in the behavior of the principal.

Theoretical considerations relating to hostility, morale, perception, self-awareness, and social perception were discussed. Hostility was defined operationally in terms of behavior to be rated by a scale. Morale was defined in three dimensions referring to aspects of group behavior indicative of the level of group effectiveness. Self-awareness referred to the degree to which an individual's evaluation of himself corresponded to the manner in which other individuals evaluated him. Social perception was defined as the ability of an individual to predict the responses of others. On the basis of the theoretical considerations and the literature reviewed, the following four hypotheses were advanced:

1. The relationship between scores derived from the teachers' ratings of perceived hostile behavior exhibited by the principal and the scores derived from teachers' ratings of their faculty morale will follow a pattern of low hostility-high morale and high hostility-low morale.

2. Teacher evaluation of faculty morale will be higher in those schools where the difference between the teachers' ratings of perceived hostile behavior exhibited by the principal and the principal's self-awareness of hostility in his own behavior is negative (teachers' ratings lower than self-ratings), than in those schools where this difference is positive (teachers' ratings higher than self-ratings).

3. The principal who manifests high self-awareness of hostility in his own behavior, i.e., a small discrepancy between his self-rating and teachers' ratings of perceived hostile behavior exhibited by the principal will more accurately predict the responses of his teachers than the principal who manifests low self-awareness, i.e., large discrepancy between his self-rating and teachers' ratings.

4. Teacher evaluation of faculty morale will be higher in those schools where the principal evidences high social perception than in those schools where the principal evidences low social perception.

The subjects of the investigation were 214 elementary school teachers and thirteen elementary school principals employed in the Poplar Grove Unified School District. The subjects responded to two basic instruments. The first was a scale constructed by the investigator on which teachers and principals rated hostile behavior exhibited by the principals. The second instrument was a faculty morale rating scale which was a revised and shortened form of three group dimension scales developed by the Personnel Research Board, The Ohio State University.

One of the major findings derived from the study is that the principal who is best off in terms of teachers' perceptions of low hostility and high faculty morale is the principal who sees himself as his teachers see him, but with a tendency to rate himself as more hostile than his teachers rate him. The

results of the study strongly suggest that the approach to locating potential areas of friction in interpersonal relations between principals and teachers by utilizing interrelated perceptions appears to be an effective technique.

133 pages. $1.66. MicA54-1395

AN ANALYSIS OF SOCIAL STUDIES TEXTBOOKS IN REGARD TO THEIR TREATMENT OF FOUR AREAS OF HUMAN RELATIONS

(Publication No. 8169)

Morton J. Sobel, Ed. D.
Wayne University, 1954

Over the years, a number of analyses of textbooks used in American schools had been made. The most recent was one performed by a committee of scholars at Harvard University in the middle 1940s. There had not been a study in recent years other than this one which analyzed treatment of minority groups in school texts. Even the Wilson attempt had become outmoded with the passage of time. Therefore, the time seemed ripe for an analysis of the subject today.

Two major questions were predominant in the analysis. One was how much space in the books was actually devoted to minority groups. The other was whether or not this space was used in a manner which tended to promote better human relations. Fifteen social studies books were selected for analysis. All fifteen were intended for use by early Adolescent children of about seventh grade level. Eleven were public school books and four were intended for use in Roman Catholic parochial schools.

The four areas considered were those of social class, racial groups, religious groups, and nationalities. Social class included subdivisions entitled upper class, middle class, and lower class.

The method of analysis involved two major steps. In the first, the books were read until there was mention of one of the four areas of human relations. A count was then made of the number of lines devoted to that area and noted on a data sheet.

The second step involved the categorization of the reference as favorable, neutral, or unfavorable to that group of people according to criteria set up previously and based on children's attitudes. This was noted on the same data sheet as was the quantitative count.

These raw data were translated into percentages based on the total number of lines in each book and upon the total amount of space in the book devoted to the specific area.

Conclusions derived from these findings were to the effect that the books tended not to be directly derogatory to the minority groups under consideration. While usually pro-American, the books verbalized One World concepts. Often, the "melting-pot" concept of citizenship was promoted.

Nationalities received the greatest amount of space, with racial groups, social classes, and religious groups following in that order. The lower class received more attention which was usually less favorable than was true with the other two classes. In the parochial school books, the lower class was treated more favorably and there was more attention to religious groups than was found in the public school books.

Racial groups received about the same amount of favorable as unfavorable space. Northern and western European groups received more favorable attention in the public school books, southern and eastern Europeans in the parochial school books. Immigrants received little attention at all, most of it unfavorable, since they were assumed to be unassimilable and competition to American labor. Russia and the Communist movement and government received rather neutral treatment in the public school books and very unfavorable treatment in the parochial school books. All of the books tended to be favorable to Latin American nations, with some paternalism evident in comparisons with the United States.

There were some errors in the books, but they did not seem to be deliberate. Certain stereotypes about groups of people occurred a number of times. All of the books mirrored the values of the authors. While there is still room for improvement, the fifteen books indicated that there is improvement over books analyzed previously and there is a deliberate attempt to emphasize better human relationships between groups.

Implications of the study were that the use of school materials by teachers rather than the materials themselves, may be the most important single factor in influencing children's attitudes toward human relations. There is a real need for increased emphasis on human relations training by teacher training institutions, perhaps through increased use of workshops, seminars, and the like on both the preservice and in-service levels. Undemocratic school practices and curricula in need of revision tend to retard better human relations. Techniques and materials in human relations which are already available are not fully utilized and the school may take a position of leadership in relation to the community in this field of endeavor. The American Creed, not fully implemented in American life, might be more adequately emphasized through indication of the vital contributions of minority groups. Children's needs can be fulfilled to some extent by the schools, but this should not be through stereotyping and scapegoating. Controversial issues have a place in the schoolroom and censorship is not a part of the American way of life.

248 pages. $3.10. MicA54-1396

EDUCATION, PHYSICAL

A STUDY OF RECREATION FUNCTIONS AND PERSONNEL IN SELECTED PRIVATE AGENCIES: TO DETERMINE THE IMPLICATIONS FOR THE SELECTION AND PREPARATION OF PERSONNEL BY THE COLLEGES AND EMPLOYMENT OF THE PERSONNEL BY THE AGENCIES

(Publication No. 7124)

Edith Louise Ball, Ed. D.
New York University, 1953

The field of recreation is a relatively new area for professional work. Due to this there has been a need for a definition of the actual work functions performed by people carrying on recreation programs. To increase the information about job functions in private agencies this study was undertaken.

The purpose of the study was to analyze the recreation functions performed by personnel in selected private agencies, and to show the relationship between the functions performed and the professional preparation of the personnel, in order to derive the implications for educational institutions engaged in training personnel, and for the agencies which employ this personnel. The six steps included in the solution of this problem were the analysis of the objectives of the agencies, an analysis of the recreation functions in the agencies, an evaluation of the inherent contribution made by the activities to the objectives; a survey of the preparation of the personnel currently employed in the agencies, a compilation of a set of principles to be used as guides in the conduct of recreation programs, and the implications to be drawn from these findings for the colleges for preparing personnel and for the agencies in employing personnel.

To secure the information to solve these several problems, it was necessary to survey the agencies and to consult the literature in the field. The survey questionnaire method was used to obtain the information about the objectives, the functions performed and the preparation of the personnel. A survey of the literature was made to give a foundation on which to compile the principles. The principles were then validated further by submitting them to a jury. The evaluation of the contribution of the recreation activities to the objectives was made by the jury who rated the activities as high, medium or low in their inherent contribution to the objectives.

The four agencies selected are the Boys' Clubs of America, the National Federation of Settlements, The National Jewish Welfare Board, and the Young Men's Christian Association. A random sampling of the operating units of these agencies, in the New York area, was made and the units so selected were included in the study.

From this study of the operating units of the agencies it was found that:

1. The objectives of the four agencies are similar, and are related to four major areas of human development, namely, health and physical, social, intellectual, and character and personality development.
2. In the judgment of the experts the recreation activities, in themselves, make only a medium to low contribution to the objectives of the selected agencies.
3. The predominant methods used in the recreation activities conducted are the group and mass methods.
4. There is a wide range of recreation activities conducted in the agencies.
5. In games, sports and physical, social, arts and crafts, and group activities more services are performed by personnel.
6. In group, social, religious and water activities a greater variety of services are performed.
7. Direct leadership, supervisory and administrative services are the three levels of recreation services performed in the agencies.
8. Volunteer leaders perform direct leadership services, primarily.
9. The agencies are democratically oriented and need personnel who can carry on this kind of philosophy.

The implications to be drawn from these findings follow. The implications for the agencies are:

1. Agencies should employ personnel, both paid and volunteer, who have an understanding of the four major areas of human development indicated, a broad knowledge of recreation skills, and a skill in the group and mass methods; for it is indicated that the activities have little value in themselves, that value is dependent on leadership.
2. There is a need to unify the job titles used in the agencies to indicate function and level of work. The titles suggested are leader, specialist and group leader on the direct leadership level, division supervisor, physical director, and program director on the supervisory level, and executive director on the administrative level.
3. Volunteer leaders need specific training to carry on direct leadership functions.
4. The agencies are democratically oriented and need to employ personnel who have this kind of a philosophy.

The implications for the colleges are:

1. Leaders in this area of work need a broad understanding of people, a variety of recreation activity skills, and a knowledge of the dynamics of working with groups.
2. The college needs to prepare persons for the various levels of work in the agencies.
3. Colleges need to assist the agencies to train their volunteer leaders.

Through shared responsibilities the college and the agency can provide more adequate recreation opportunities for participants.

607 pages. $7.59. MicA54-1397

EDUCATION, PSYCHOLOGY

A STUDY OF CRITICAL INCIDENTS IN EFFECTIVE SECONDARY SCHOOL TEACHING AS CONCEIVED BY PUPILS AND FACULTY

(Publication No. 8128)

Maurice Wesley Manbeck, Ph. D.
University of Minnesota, 1954

In this investigation the problem of defining teaching competence has been studied by the use of critical incidents. A description of the effective teacher has utility for both the guidance of teacher education and for the merit rating of teachers in service. This study classified incidents of teaching behavior which to pupils and faculty were indicative of effective and ineffective teaching. Personnel in ten public secondary schools of St. Paul, Minnesota supplied data for this study. Samples of the populations of pupils, teachers and principals reported incidents of teaching behavior which were judged by the respondent to be particularly effective and/or ineffective.

The method of studying the behaviors was patterned after the Critical Incident Technique as developed by John C. Flanagan in his studies of Air Force personnel. In the use of this technique the investigator examined those aspects of secondary school teaching which were considered critical to success or failure on the job. In this study examination, combination and classification of many critical incidents was used as the basis for critical requirements of the profession.

This study used incidents reported by secondary school pupils and faculty members. Over twenty four hundred incidents of teaching behavior were examined, abstracted and classified to obtain a set of behavior statements which represented the experiences with effective and ineffective teaching of the respondents in one urban area.

There were forty-three behavioral categories in this set which seem to be useful for forming an observer's check list or rating scale. These teaching behaviors were classified into two general areas (1) teacher-pupil relationships and (2) methods and classroom procedures. Each of these general areas was further subdivided into sub-categories – four effective and four ineffective.

In the first general area behaviors were classed under (a) the discretion with which pupil behavior problems are handled; (b) the sensitiveness of the teacher to pupil reactions when corrections are made; (c) the personality qualities affecting teacher-pupil relationships; (d) the motivational activities related to psychological needs of pupils.

The second general area had behaviors classed under (a) the clarity and manner in which materials are presented; (b) the degree to which individual differences are recognized in teaching procedures; (c) the organization of instructional material and classroom activities in terms of progress toward objectives; (d) the degree to which learning aids are utilized.

Two different groups of three and four judges each were used to check on the communicability and understandability of the category descriptions used to represent the incidents of teaching behavior. A list of the behavioral descriptions was submitted to fifty-three experienced teachers from non-urban secondary schools. This group expressed substantial agreement regarding cruciality of the teaching behaviors listed. This served to check that the analysis of incidents and their subsequent translation into categories had selected and clearly stated important teacher behaviors.

A chapter comparing other lists of teaching behaviors with the list developed here was included. The two studies representing the eastern and western areas of the United States gave many evidences of similarity of behaviors with the present study conducted in the midwest.

200 pages. $2.50. MicA54-1389

EDUCATION, TEACHER TRAINING

A STUDY OF THE EFFECTIVENESS OF THE STUDENT PERSONNEL SERVICES AND ADEQUACY OF GUIDANCE AND RELATED COURSE OFFERINGS FOR TEACHER TRAINING AT PHILIPPINE NORMAL COLLEGE

(Publication No. 8067)

Eleanor Tengonciang Elequin, Ed. D.
Michigan State College, 1954

The Problem

This study attempted to determine the opinions of students, alumni and faculty at Philippine Normal College concerning (1) the effectiveness of the student personnel services provided by the college in promoting student adjustment; and (2) values accruing from course offerings in guidance and related fields for teacher trainees in the development of competencies and acquisition of experiences for successful teaching.

Method, Technique, and Data

Data were obtained from 372 lower division students, 296 upper division students, 37 alumni, and 19 faculty respondents through the use of questionnaire forms. Analysis of questionnaire returns from the four groups was made by getting a frequency count of responses under the categories provided and computing the corresponding percentages.

Findings and Conclusions

In addition to revealing personal data about the students, alumni, and faculty, results of the survey indicate that:

1. In general, findings revealed satisfaction with the orientation program on the part of all the respondents. Particular aspects rated very valuable were: (a) group conferences with student leaders; (b) making of tours of the neighborhood;

(c) faculty-student "get-togethers" or "mixers"; (d) an orientation course for freshmen and transfer students; (e) student handbooks; (f) lectures on rules and regulations; and (g) convocations.

2. With respect to the seeking of the Dean of Student Affairs for help in personal problems, there was a tendency for the alumni to get such help which was not indicated by the lower and upper division students. It was evident that respondents from the student and alumni groups were reluctant to give their reactions concerning the Counseling Services.

3. Elements of the student activity program rated very valuable by the student and alumni groups were: (a) student government (b) Social organizations; (c) publications as The Torch; (d) athletic activities; and (e) music. Student and alumni respondents further indicated that the student activity program is highly coordinated by the Adviser of Student Organizations while the faculty respondents were of the opinion, that it could do more for the non-participants.

4. All the respondents were in agreement that all students except those who have homes in Manila should live in college-owned or approved residences. It was further indicated that group life at Philippine Normal Hall is satisfactory.

5. It was the opinion of all the four groups surveyed that the dispensary services meet the existing needs of the student body. However, psychiatric service and emergency hospital services are not available for the students.

6. There was general disagreement among the lower division students, upper division students, alumni, and faculty respondents with respect to such items as short-term loan funds, financial counseling, part-time employment services, and direct aid to the needy student.

7. The majority of the student and alumni respondents favored the establishment of a placement service for all students. Placement activities rated essential by the students and alumni were considered of little value by the faculty respondents.

8. All the groups were in agreement that discipline measures at PNC are remedial and not punitive in nature. There was also general agreement that the office of the Dean of Students Affairs makes preliminary investigations in discipline cases.

9. There was general disagreement among the faculty respondents regarding phases of the admissions procedures and maintenance of student personnel records.

10. Comments made by the upper division students, alumni, and faculty respondents were tabulated and represented a diversity of opinions concerning guidance and related course offerings. Criticisms were concerned mainly with the need for functionalization of these courses through the use of more adequate audio-visual aids, up-to-date references, observations of actual cases in the Training Department, field trips to the community agencies and institutions, adoption of Filipino standards to replace American standards, lengthening of the time allowed for some of the courses, and more supervision of teacher trainees who are on internship training in off-campus schools.

11. Students, alumni, and faculty respondents seem to be aware of the role played by the student personnel services on the campus and the values of guidance and related course offerings in the education of teacher trainees.

328 pages. $4.10. MicA54-1398

EDUCATION, THEORY AND PRACTICE

CHILDREN'S PROCEDURES IN INTERPRETING READING MATTER ACCOMPANIED BY MAPS

(Publication No. 8168)

Miller Raymond Collings, Ed. D.
Wayne University, 1954

This study was undertaken to determine the procedures and reactions of children as they worked in a study situation requiring map-text reading. The investigation shows that previous knowledge concerning this problem is negligible. It identifies and appraises children's reading habits in such a study situation. It also exemplifies desirable teaching techniques in map-text reading. Furthermore, it ascertains the degree to which children's attainments in map-text reading can be improved through the application of such techniques.

One hundred eight eighth-grade boys and girls were selected as participants for the study. They were equally divided as to sex, and of at least average reading ability. They represented the upper, middle, and lower socio-economic areas. All had experienced systematic instruction in the social studies since Grade 2. None was over-age, under-age, or color-blind.

The pupils were observed, tested, and interviewed on their map-text reading approaches to a suitable geographic passage accompanied by maps. The examiner observed carefully the various approaches to the reading material used by the children. He recorded the children's answers to the test questions. Extensive notes were taken on the observation and interview experiences. Also, an experimental group was given instruction in map-text reading, and the effect on their achievement was determined by comparison with results obtained from a control group having no such instruction.

The results of this investigation confirm the findings of previous map reading investigations, revealing poor map reading ability. Although there was a great range in achievement among individual participants, the average performance was disappointingly poor. Socio-economic status, sex, intelligence, and general reading ability are shown to affect achievement in map-text reading.

Among the conclusions drawn from the data reported are these:

1. Map-text reading requires the use of special reading skills additional to those involved in reading either maps or verbal text.

2. Average children do not acquire the essential

map-text reading skills through incidental use only. This is shown by the fact that instruction during a single lesson overcame many map-text reading difficulties.

3. Children hesitate to ask questions seeking clarification, either because of fear or because they have not been sufficiently challeneged by the presentation.

4. Children recognize the value of geography study and are eager to become more competent in this endeavor.

The investigator recommends that authors of social-studies textbooks construct reading materials so as to present rich opportunities for map-text reading. It is also suggested that inexpensive fold-up type wall maps and/or 2 x 2 colored slides, duplicating the maps in the book, be published as an aid to learning in group situations.

The investigator also recommends that curriculum experts provide for systematic curricular experiences that will teach map-text reading skills, beginning with simple experiences and gradually including complex skills. This necessitates identifying and grading the skills. School officials should also insure that teachers have books with adequate and appropriate map equipment. They should convince teachers of the need for definite teaching of map-text reading. They should also work with teachers to refine instructional techniques in specific map-text reading skills.

Teachers should survey the degree of understanding evidenced in map-text reading and start instruction from where the children are. Then they should select social studies textbooks in terms of children's reading abilities rather than publisher's grade placements.

They should build on children's natural liking for geography and encourage a questioning attitude toward geographical material.

Classroom teachers should encourage critical thinking to obtain a joint interpretation of data from text and maps in combination in order to solve problems. Only when such steps as the foregoing are taken will children leave the elementary school well equipped to interpret textual materials accompanied by maps. 246 pages. $3.08. MicA54-1399

HENRY PHILIP TAPPAN'S CONCEPTIONS OF THE STRUCTURING OF UNIVERSITY FUNCTIONS

(Publication No. 8226)

Lois Mayfield Wilson, Ph. D.
Stanford University, 1954

This dissertation deals with a philosopher-educator who, exactly a century ago, attempted to interpret the educational needs of the distinctive society which had grown up in the United States – Henry Philip Tappan who believed that the young nation above all else needed a university. He averred that it had none, and he proposed to remedy the lack. Specifically the dissertation deals with Tappan's conceptions of the functions of the university he hoped to create, with his plans for organizing or structuring these functions, and with the actions he took. From 1852 to 1863 Tappan served as Chancellor of the University of Michigan, the institution which he sought to reconstruct into "a true university."

Chapter One describes the Old American Literary College, the simple higher educational structure established on British models during the colonial period for the moral, religious, and intellectual training of students. This chapter, in brief, sketches the characteristics of the foundational institution of American higher education, the institution which still flourished in Tappan's day.

Chapter Two reviews several plans for establishing an American university which were prepared during the early decades of the nation's history. It then describes the 1817 proposal for the creation of the Catholespistemiad or University of Michigania. The institution, however, did not open until 1842 and with very different lineaments from those envisioned a quarter century before. Not until 1852, moreover, did it get seriously under way: in that year its governing board elected its first executive head in the person of Henry Philip Tappan.

Chapter Three begins with a consideration of mid-century educational tensions as analyzed by President Francis Wayland of Brown University and by Dr. Tappan. Both men agreed that the onrushing new knowledge could not be embraced by the outmoded colonial college, but they disagreed about what needed to be done. Wayland recommended that instruction in any subject for any length of time be offered by the existing but remodelled colleges. Tappan scorned this egalitarian, Jacksonian formula. He described all existing American colleges as mere intermediate level institutions whose proper functions should be to prepare students for university study. Then he outlined his Architectonic Ideal.

Chapter Four discusses the Prussian sources of Tappan's Architectonic Ideal. The University of Berlin, the greatest university of the nineteenth century, stood before Tappan as a model which he approved, admired, and copied.

The Prussian university topped a three-level national educational structure, and Chapter Five shows that Tappan's blueprint included the same three levels. In one of his first statements after his arrival in Ann Arbor he called it a secondary school, not a university. He sought to convert it into his conception of a university and, in the process, to organize a three-level educational system for the State of Michigan.

Chapter Six discusses in detail the five functions which Tappan conceived of as proper to a university.

Chapter Seven, which summarizes and evaluates Tappan's structural and functional theories, also traces them through the course of development which led to their adoption or rejection after his career ended. 192 pages. $2.40. MicA54-1400

NUMBER REARRANGEMENT AS ARITHMETICAL LEARNING

(Publication No. 7581)

Robert Keith Woods, Ph. D.
State University of Iowa, 1954

Chairman: Assoc. Prof. Herbert F. Spitzer

The use of objects, the relationships within the number system and the major characteristics of our notational system are among the most recent suggestions for the improvement of arithmetic.

This use of objects and drawings in early arithmetical instruction has led to a revival of interest in old psychological considerations regarding the form or pattern of objects or drawing to be used in the presentation. A more recent development resulting from this early use of drawings and objects is the suggestion that a pupil's arithmetical ability will be markedly improved if he is taught to group the objects or drawing representation of quantities.

This study was undertaken to find out (1) the extent to which children can be taught to apprehend representations in straight line number patterns during a period of intensive instruction, (2) whether or not children see and apprehend timed exposures and if so to what extent they can be taught to see larger groups, (3) the relationship that exists between the ability to group and general arithmetical ability and (4) the relative difficulty of apprehension of various groupings of numbers 2 through 10.

Two tests, grouping and general achievement in arithmetical skills were constructed and administered prior to and after three weeks of instruction by the writer. The grouping test consisted of slides of number patterns 2 through 10 projected at the rate of one-tenth second per exposure. A test of general achievement in arithmetic similar to a standardized test was administered.

Pupil study consisted of roughly equal amounts of time in apprehending and recording projected number pictures at one-tenth second per exposure and in working at individual rates of speed on specially constructed exercises of number groups containing materials leading to concepts of four fundamental operations.

In all 96 and 114 pupils of Grades II and III respectively participated in the experiments during the period of April 18 through May 27 of the school year 1952-1953. Children in schools I and II (Experimental) were instructed 30 minutes daily by the writer during a period of three school weeks. Children in School III (Control) received 30 minutes of usual classroom instruction as to content and techniques by their classroom teachers during a period of eight days. School IV (Benchmark) received no instruction between the two testing periods.

Data obtained under conditions of the study appear to support the following conclusions:

1. The means made on all parts of Test II, Grouping and Counting by both grades were not statistically significant.
2. Grade gains made on all parts of Test I, General Achievement in Arithmetic Skills, were not as great as those made on the grouping test. Gains can be explained on basis of sampling error.
3. The relationship between ability to group and general achievement in arithmetic skills was positive but not high. Higher correlations were made by the children of Grade III than by those of Grade II.
4. Relationships between ability to group and abilities to count forward and backward were higher in Grade III than in Grade II.
5. Relative difficulty of straight line uninterrupted patterns varied directly with the number of circles in the number pictures.
6. Relative difficulty of straight line interrupted patterns varied according to the size of the sum of subgroups and size of the larger of two subgroups.
7. Doubles or equal sized subgrouped numbers were much easier for children to comprehend than were the corresponding whole groups.
8. Difficulty of numbers after 4 increased rapidly from number to number.
9. All uninterrupted number pictures including 3 through 10 were more difficult to apprehend for children in Grade II than for children in Grade III.

250 pages. $3.13. MicA54-1401

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

ENGINEERING, GENERAL

THE MANAGEMENT OF WAGE INCENTIVES

(Publication No. 7566)

Maurice D. Kilbridge, Ph. D.
State University of Iowa, 1954

Chairman: Professor J. Wayne Deegan

This dissertation is a study of the problems involved in the management and maintenance of wage incentive systems. It is one thing to design and initiate an incentive plan and quite another to maintain it in good condition through changing times and modifying circumstances. Management frequently fails to realize that the continuing operation of an incentive system over a period of time is every bit as difficult and demanding as its design and installation. This study analyzes the responsibilities of incentive operation and proposes a set of principles of incentive management to guide those who are confronted with the urgent need of operating an incentive system under the day-to-day strains that are put upon it.

A survey of why incentive systems fail reveals certain critical areas to which management's attention should be drawn. These include, control of work conditions, product quality, and maintaining standards in relation to job content. Each of these is the subject of a separate chapter. Personnel problems associated with wage incentives, restriction of output, and union policy regarding incentive wage methods are also discussed. The dissertation continues with a presentation of statistical measures of effectiveness, controls and reports, and advice on how to revise a degenerate incentive system.

The conclusion is finally drawn that there are four prime requisites for the successful operation of an effective wage incentive system. These are: (1) Mutual trust and confidence; (2) Competent, honest management; (3) Cooperative and informed employees; and (4) Internal consistency of the system. Any system can be made to function if it is internally consistent. Although on the surface it may appear awkward and unmanageable, if it does not involve contradictions in policy or practice, and contains an internal system of checks and balances consistent with itself, it can operate effectively in opposition to all so-called rules of sound incentive practice. It cannot operate, however, in opposition to the will of those involved. In the final analysis, the success of an incentive plan depends upon the desire of those involved to make it work.

295 pages. $3.69. MicA54-1402

A CONCEPT OF ORGANIZATION AND MANAGEMENT

(Publication No. 7567)

Melvin R. Lohmann, Ph. D.
State University of Iowa, 1954

Chairman: Professor J. Wayne Deegan

Before a critical study of any phenomena can conveniently be made, it is necessary to seek some uniformities of the phenomena that can be defined or described. The phenomena can then be classified into the defined uniformities and subjected to critical inquiry.

The phenomena under consideration are cooperative systems of all kinds, but particularly industrial organizations. The basic elements of cooperative systems are the activities of persons. Consciously coordinated acts of persons can be classified on the basis of the means of coordination into either formal unit organizations or informal unit organizations. The acts which comprise a formal unit organization are either managerial or operative, depending on whether the acts stimulate and coordinate other acts, or are acts being coordinated. A complex of formal and informal unit organizations such as found in industrial enterprises is an organization.

The first three chapters are devoted to the development of a conceptual scheme of organization. Definitions of the two kinds of unit organizations, formal and informal, are proposed and the structure of an industrial organization is analyzed in terms of the formal and informal organizations in existence at a particular moment. The growth of an organization is traced through the addition of unit organizations composed of acts specialized as to time, place, person, things, or manner.

The core of the conceptual scheme is the three essentials of unit organization. A unit organization can come into being when two or more contributors:

(1) Know and agree upon a prospective resultant of cooperation,

(2) Recognize incentives that induce the contribution of activities,

(3) Perceive the acts needed to achieve the prospective resultant.

These three essentials of organization must be present simultaneously for every contributor for a unit organization to exist.

Contributors to a formal unit organization need a manager to the extent that they cannot self-stimulate or self-coordinate their activities. The activity of managing is defined in Chapter IV as the activity of communicating to contributors to aid them in agreeing upon a resultant, recognizing incentives,

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

and perceiving the acts needed to achieve purposeful coordination of their activities.

The process of communication, which includes the activity of managing, is discussed in Chapter V, particularly from the viewpoint of the limitations of a complete transfer of thought from a manager to an operative contributor. Messages that simultaneously meet the four essentials of communication are acceptable by receivers as controlling the actions they contribute. A communication that is accepted by a contributor as controlling his activities is authoritative.

The effectiveness of a message projected by a manager which is intended to stimulate and coordinate the activities of contributors is limited by the manager's preparation to communicate. The preparation, which is considered in Chapter VI, includes obtaining and evaluating information and deciding upon the message to be communicated. The decisional process is preparation to manage, not a managing activity nor an activity of a unit organization.

The conceptual scheme of organization and management developed is applicable to all organizations and is valuable as a framework of reference to integrate the present techniques of management.

284 pages. $3.55. MicA54-1403

ENGINEERING, CHEMICAL

I. DIFFUSION IN LIQUID SULFUR.
II. EFFECT OF TEMPERATURE IN THERMAL DIFFUSION.

(Publication No. 7869)

Ronald Luther Saxton, Ph. D.
University of Illinois, 1954

PART I. DIFFUSION IN LIQUID SULFUR

Molten sulfur is unique among liquids because of the shift in molecular structure that occurs in the vicinity of 160° C.. This transition is evidenced most strikingly by a 13,900-fold increase in the viscosity of the liquid, although many other physical properties also are affected.

To elucidate the nature of the transition molecular motion in liquid sulfur was studied by measuring the diffusion coefficient of S_{35} in S_{32}. The range of temperature covered was from 122° to 316° C. The radioactive-tracer technique can be summarized as follows:

(a) Sulfur containing radioactive (S_{35}) atoms was allowed to diffuse into molten (nonradioactive) sulfur, that was held in a cylinder of porous glass.

(b) The diffusion was effectively halted by rapidly freezing the liquid.

(c) The concentration of tagged molecules was determined as a function of distance by cutting samples from different levels of the cylinder and measuring their activity.

The diffusion coefficient was computed from the concentration gradient and the time that diffusion proceeded.

The results of these experiments were:

(a) The maximum in the graph of D versus t lies at 149° to 152° C., from 5 to 8 degrees below the minimum in the viscosity-temperature curve.

(b) Between this maximum and the minimum (ca. 200° C.) D falls by a factor of about 5.5, compared with a 13,900-fold increase in viscosity in the same range.

(c) The effect of impurities (e.g. oil and iodine) is much less on the diffusion coefficient than on the viscosity.

The results can be interpreted according to the theory of a shift in molecular structure from eight-membered rings to long, "polysulfur" chains. From (b) and (c) above it appears that in the motion of the polysulfur molecule the moving segment is shorter for diffusion than for viscous flow.

PART II. EFFECT OF TEMPERATURE IN THERMAL DIFFUSION

Thermal diffusion is a transport phenomenon in which a redistribution of the components of a solution is effected by a flow of heat through the system, i.e. in which a gradient in concentration is produced by the imposition of a gradient in temperature.

The purposes of this work were to study thermal diffusion in systems of nonpolar liquids, and to investigate the effect of temperature on thermal diffusion in such systems.

Brass cells of the two-chamber type were employed in the experiments. Thermal diffusion ratios were measured over the temperature range 10° to 55° C. for the solutions: carbon tetrachloride – carbon tetrabromide (eight mole percent), s-tetrachloroethane – carbon tetrabromide (nine mole percent), ethylene bromide – ethylene chloride (equimolar), and for equimolar mixtures of s-tetrachloroethane with the following normal paraffin hydrocarbons, hexane, heptane, octane, nonane, tetradecane, and octadecane.

For all these systems the effect of increasing temperature was to reduce the thermal diffusion ratio. Over the range of temperature 10° to 55° C. the decrease in α amounted to from 12 to 25 percent (based on the value at 10° C.). The other results of this investigation can be summarized by the following conclusions:

(a) The direction, and, qualitatively, the magnitude of the separation obtained in the thermal diffusion of binary liquid mixtures is usually predicted by the difference in the thermal pressures of the components.

(b) The controlling property in condensed-phase thermal diffusion seems to be the cohesive enthalpy.

(c) A formulation of the cohesive enthalpy that shows promise is $H_o^* = T(\partial P/\partial T)_V \left[V - T(\partial V/\partial T)_p\right]$.

(d) In the thermal diffusion of long-chain hydrocarbons segmental motion obtains.

224 pages. $2.80. MicA54-1404

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

HEAT TRANSFER TO VISCOUS MATERIALS IN JACKETED AGITATED KETTLES

(Publication No. 8163)

Vincent William Uhl, Ph.D.
Lehigh University, 1952

This study extends available information for heat transfer in jacketed agitated kettles to very viscous liquids. The agitators tested were a paddle for which considerable data are already available and a flat-bladed turbine and anchor for which data are scant. The liquids used were heavy bodied linseed oil and cylinder oil. Kettle was 2-foot diameter, 50-gallon capacity. Tests were batch for heating and cooling and covered speed ranges from 50 to 250 rpm. Power data were obtained to completely define the systems and to allow correction to sensible heat change for the mechanical energy degraded to heat. Results show that the usual heat transfer relation holds for the paddle data which covered the turbulent to the viscous range prior to the transition region. The baffles had no measurable effect on the rate of heat transfer. A similar correlation held for the turbine except that the results were limited to the transition range. For the anchor agitator the usual relation with an exponent of 2/3 for the Reynolds number held for the transition region, but in the definitely viscous zone, the exponent was 1/2. In addition the correlations which were based on considerable data over a wide viscosity range indicated that the viscosity ratio (for liquid at wall to average liquid viscosity) designed to bring heating and cooling data into agreement should have an exponent of -0.24 for paddle and -0.18 for anchor agitators. This differs from the value of -0.14 used by previous investigators. 214 pages. $2.68. MicA54-1307

ENGINEERING, CIVIL

AN INVESTIGATION OF THE TWO-WAY PRESTRESSED CONCRETE SLAB

(Publication No. 8118)

Carl Edwin Ekberg, Jr., Ph.D.
University of Minnesota, 1954

A two-way prestressed concrete slab is suggested which may be built up from individually prestressed units. The form of prestressing advocated is called posttensioning, because the steel reacts against the concrete by means of end connectors and bond between steel and concrete is not utilized. The individual units would be transported to the building site and placed side by side on the four supporting members to form the slab. The second posttensioning then would be applied through the use of steel passing in a direction at right angles to the steel of the individual members.

The analytical treatment of the problem assumed a homogeneous square plate simply supported around the four edges. Equal prestressing forces were assumed to act along the middle surface of the plate in two directions with lines of action essentially parallel to the edges of the slab. The treatment of the problem was based on the elastic theory of plates, and is only valid if there are no cracked sections. The effect of plastic flow was not investigated.

The testing was carried out on a concrete slab which measured approximately seven feet square and one and one-half inches thick, and was built up from seven individually posttensioned members of one foot width. Each plain concrete member was prestressed by wrapping a single piece of wire length-wise around the outside to form six loops. The two ends of the wire were secured by special clamps at one end of the beam, and the loops at the other end were engaged in cap screw assemblies. The cap screw assemblies enabled the rapid adjustment of wire tension. The seven individually prestressed members were placed side by side on simple supports which were set exactly eighty inches apart. The second prestressing was then achieved by wrapping a single piece of wire around all seven beams to form forty-two loops. The two ends of the wire were clamped to one edge of the slab, and the loops at the opposite edge were passed over a system of additional cap screw assemblies.

The simply supported test slab was loaded with iron and concrete weights which were applied in five increments up to a design load of 225 pounds per square foot. The first run was made with a prestress in two directions of approximately 1312 pounds per square inch in the concrete. The second and third runs were made with prestresses of 1103 and 1521 pounds per square inch, respectively. On the third run, the slab was subsequently loaded to twice the design load without appreciably harmful effects. Strain readings in the concrete were taken, as well as slab deflections for the various loadings. Upon completion of the third run, the slab was dismantled, and load-deflection tests were made on two of the individually prestressed beams.

All experimental data related to the slab loading was plotted and the results compared to the corresponding theoretical values. A theoretical study was made of the state of stress at various points on the slab surface for the condition of maximum loading. Design curves, based on the elastic theory and experience gained from the test slab, were proposed. The design curves give required slab thickness and prestress for a considerable range of slab sizes and loadings. The scope, however, was limited only to uniformly loaded square slabs which employ posttensioned and unbonded steel.

143 pages. $1.79. MicA54-1405

ENGINEERING, ELECTRICAL

THE INFLUENCE OF POSITIVE IONS ON ELECTRON-BEAM PROFILES

(Publication No. 8224)

Behram H. Wadia, Ph. D.
Stanford University, 1954

The presence of residual gas within the envelope of an electron tube leads to the formation of positive ions by collision with electrons. Because of the nature of the fields in the drift space, the ions formed are in continuous motion toward the cathode and a variation of ion density in the drift space results. This distribution of positive ions determines the net negative charge effective at each point in the drift space and hence controls the shape of the beam. This work concerns the possibility of controlling the positive-ion distribution in such a manner as to obtain a nondiverging electron beam.

The loss of positive ions to the cathode may be counteracted in two ways. First, by increasing the pressure, one may obtain such a high rate of production of ions that complete neutralization is possible despite the losses. Alternatively, the flow of ions toward the cathode may be eliminated by interposing a positive hump of potential in their path. Both these methods of control have been known for some time, but their simple theory has not found any consistent experimental support. Consequently it is necessary to enlarge upon the simple principles and to modify them in order to obtain a full understanding of the phenomenon and to correlate theory with experiment.

The results of the investigation indicate that both methods of control involve more complicated phenomena than are accounted for in the prevailing simple theory. The first method cannot be widely applied because of practical considerations, but the second, which avoids these disadvantages, should find some application. The investigation also shows that the design of the second method, called ion trapping, is only possible by a process of trial and error. Qualitative suggestions are made which can be of help in designing an acceptable trapping system. 73 pages. $1.00. MicA54-1406

ENGINEERING MECHANICS

STEADY-STATE OSCILLATIONS IN NONLINEAR SYSTEMS OF TWO DEGREES OF FREEDOM

(Publication No. 8209)

Frank Robert Arnold, Ph. D.
Stanford University, 1954

The Ritz Averaging Method (Second Ritz Method, or Galerkin Method) is described for multi-degree of freedom systems in general and applied to determine approximate solutions to the steady-state oscillations of nonlinear systems having two degrees of freedom. Although the form of the general model system treated is a mechanical one, facts concerning its behavior are directly applicable to certain analogous electrical systems.

The mechanical model is frictionless and consists of a main spring-mass system, on a rigid foundation, connected to an auxiliary mass through a coupling spring. An harmonic disturbance is considered to be applied at the main mass to produce oscillations of the assembly. The Ritz Method is used to arrive at the necessary equations to determine the effects on system behavior of various combinations of cubic-type nonlinearities in the main and coupling springs. Part of the study is devoted to the determination of parameter values necessary to produce a desired system behavior. All procedures are presented first in generality and then applied to specific systems. The results are shown in dimensionless Response Diagrams which are equivalent to plots of displacement amplitude versus frequency for various disturbance amplitudes.

The completely linear form of the systems treated is the well-known "dynamic vibration absorber." In contrast with the linear system which has two distinct resonance frequencies, the nonlinear systems have at most one resonance frequency. There is exactly one resonance frequency if one of the two springs is linear; if both springs are nonlinear, there is no resonance effect whatever. That is, there are no infinite amplitudes occurring at finite frequencies. If the main spring alone is nonlinear, the resonance frequency is that of the linear auxiliary system as a single oscillator. If the coupling spring alone is nonlinear, the resonance frequency is equal to that of a single-degree of freedom system consisting of the linear main spring and a mass equal to the total mass of the two-degree of freedom system.

The analogous electrical systems consist of resistance-free coupled circuits containing nonlinear capacitances or inductances (describing saturation effects). The correspondence between parameters of the mechanical and the electrical systems is given to permit interpretation of the system response diagrams with respect to the electrical analogs. 189 pages. $2.36. MicA54-1407

A GENERAL THEORY OF DEFORMATIONS OF MEMBRANE SHELLS

(Publication No. 8218)

Franz Thomas Geyling, Ph. D.
Stanford University, 1954

The purpose of this dissertation is to develop a membrane theory of deformations for shells of arbitrary shapes besides surfaces of revolution and cylinders which have been treated in the past. Cartesian coordinates and projected membrane forces are used whereby many of the formal details parallel those of the Pucher method of solution for

membrane stress problems. This method is reviewed for reference and some stress problems of the elliptic and hyperbolic types are discussed. For the latter type a brief résumé of suitable integration methods is given.

After a derivation of the kinematic and elastic relations the elasto - kinematic equations between the displacement components u, v, w and the membrane forces $\overline{N}_x$, $\overline{N}_y$, $\overline{N}_{xy}$ follow as

$$u_x = - w_x z_x + f \; ; \; v_y = - w_y z_y + g \; ; \text{ and (202) (203)}$$

$$u_y + v_x = - w_x z_y - w_y z_x + k \; ; \text{ (204)}$$

where f, g, k contain the membrane forces. Elimination of u and v from these equations yields a differential equation for the vertical deflection w:

$$L(w) \equiv w_{xx} z_{yy} - 2 w_{xy} z_{xy} + w_{yy} z_{xx} = R, \text{ (206)}$$

where the operator L is typical of the Pucher method. R contains the membrane forces. Assuming w as known, u and v may be obtained from (202), (203), (204) by quadratures. As an alternative, differential equations similar to (206) are developed for u and v from (202), (203), (204) whose second order operators are again L.

In most structural applications the edges of a shell are supported by vertical shear diaphragms. The various constraining actions of such an edge member are formulated as boundary conditions for the deformations. Amongst them the most important and useful one, in terms of w, is that there be no tangential sliding between the edge of the shell and the diaphragm. Shells with positive Gaussian curvature are studied first and particular attention is given to the deformations of an elliptic paraboloid with four edge diaphragms under uneven settlement of the corner supports, surface loading, edge shear loads and other circumstances. The results of these investigations are applicable to structural practice.

The corresponding problems are then developed for the hyperbolic paraboloid as an example for shells of negative Gaussian curvature. A study of its inextensional deformations reveals that inextensional deflections with homogeneous boundary conditions may occur in such a shell if a critical or eigenvalue condition is satisfied. The same shell with uniform surface loading is discussed as an example for extensional deformations. This investigation serves mainly to point out the discontinuities along dividing characteristics in such hyperbolic membrane problems which make their solutions rather unrealistic.

The thesis shows that the membrane theory produces quite acceptable results for the deformations in elliptic cases but it shows also that in hyperbolic cases the results of similar computations are of a rather limited value and call for the development of the bending theory.

146 pages. $1.83. MicA54-1408

ELASTIC WAVE PROPAGATION AND VIBRATIONS IN PLANE STRESS AND FLEXURE

(Publication No. 8219)

William Edward Jahsman, Ph. D.
Stanford University, 1954

Solutions are given for a closely-related set of problems of two-dimensional vibrations and wave motion in homogeneous, isotropic, elastic plates. The set can be divided roughly into two parts: (a) in-plane (plane stress) motion; and (b) transverse (flexural) motion.

The first part is introduced by developing the equations of motion in plane stress. It is shown that two distinct types of motion appear: irrotational, in which an element undergoes dilatation but no rotation, propagating at the velocity $c_1 \equiv \sqrt{\frac{E}{(1-\upsilon^2)\rho}}$; and equivoluminal, in which the element undergoes rotation without dilatation, propagating at the velocity $c_2 \equiv \sqrt{\frac{G}{\rho}}$.

Several examples of wave motion in thin plates and rings are studied in the first part: (a) symmetric, extensional vibrations; (b) rotational oscillations of a wheel with a fixed inner hub, a ring web of appreciable inertia, and a heavy outer rim; and (c) travelling waves around a ring. In case (a), it is possible to plot the fundamental frequency versus the ratio of the inner to the outer radius of the ring. Case (b) yields a frequency equation from which a family of curves of frequency versus inner to outer radius ratios can be given for various ratios of ring inertia to rim inertia. When these curves are compared with those predicted by the Rayleigh approximation for the ring web inertia, it is found that the two sets are almost identical for a wide range of ring to rim inertia ratios.

The final study in the first part contains several examples of the response of an infinite plate to the introduction of a step disturbance at a central hole. An example using Laplace transforms is reviewed from a paper by Kromm on the axially symmetric disturbance created by a sudden pressure or radial velocity rise at the central hole, and this analysis is here employed directly to determine the disturbance created by the introduction of a sudden rotatory motion at the hole, by a prescribed circumferential velocity or shear stress. The method of characteristics is applied in these examples, as well as in others not amenable to the operational methods, to determine (a) the velocities of propagation (b) the attenuation of the disturbance "jumps" at the wave front as they are propagated into the plate. Specifically, from an arbitrary localized step disturbance, two wave fronts will be created, diverging with the velocities c_1 and c_2 and diminishing as $\frac{1}{\sqrt{r}}$, where r is the distance from the origin to the wave front. Finally, numerical integration is used on a simple example of wave propagation. The difficulties of this method using a manually-operated calculator

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

are discussed, and the use of card-programmed machine computation is suggested.

In the second part, elastic flexural shock wave propagation in plates as predicted by the classical plate theory and the corrected plate theory, which includes rotatory inertia and shear effects, are compared. The Boussinesq solution to the classical plate equation is given, and the inability of the solution to predict a finite velocity of propagation is pointed out. The corrected equations of motion are derived, after Uflyand and Mindlin. Three boundary conditions are required rather than two as in the classical plate theory. Application of the method of characteristics reveals that for the most general case of a localized step disturbance creating flexural motion, three wave fronts are produced which travel at the velocities c_1, c_2, and κc_2 (where κ is a measure of the shear correction in the revised plate equations) and diminish as $\frac{1}{\sqrt{r}}$.

171 pages. $2.14. MicA54-1409

FLEXURAL WAVES IN BEAMS

(Publication No. 8227)

Edward Eugene Zajac, Ph. D.
Stanford University, 1954

This investigation deals with the analysis of wave motion in beams according to the theory which results when shear deformation and rotatory inertia corrections are added to elementary beam theory.

The question of whether or not this theory, recently called the Timoshenko theory, describes wave propagation in actual beams has aroused considerable discussion in the literature. Therefore, a somewhat detailed history of the evolution and previous application of the theory is given in Chapter I.

In Chapter II, qualitative aspects of the theory are discussed. A simple mechanical model is presented which illustrates in terms of discrete elements the behavior of the idealized continuous beam upon which the Timoshenko theory is based. Some of the results mentioned in Chapter I concerning the propagation of discontinuities, dispersion, phase and group velocities, etc. are extended, and others discussed from a new viewpoint.

In Chapter III, solutions of the differential equations of the Timoshenko theory by means of the Laplace transform are shown. The problem of a semi-infinite, simply supported beam loaded at its hinge by a step-function bending moment is used to illustrate the methods of solution which are presented. These solutions are obtained by two techniques:

(1) expansion of the transform into an infinite series and term by term inversion
(2) use of the complex inversion integral.

The first technique yields the solution directly behind the wave front in terms of a rapidly convergent series of Bessel functions. In addition, it gives the power series development of the solution in terms of time and distance from the load and a solution which is asymptotic in time. With the second technique, the solution is obtained in the form of real definite integrals. These are evaluated to give an alternate asymptotic representation.

In Chapter IV, finite difference methods of numerical solution are studied. It is shown that a stable central difference representation is impossible, and the best one can hope for is linear instability if central differences are used. Criteria for mesh lengths which insure at least linear instability are derived. However, numerical examples show that linear instability still gives rise to prohibitive growth of round-off errors and that the use of central differences is not practical. Methods of determining the stability of non-central difference equations are also discussed. A simple means of determining the roots within the unit circle of a fourth degree polynomial is given in Appendix II to provide the necessary tool for such determinations. This tool is used to show that the difference representation of the Timoshenko equation which employs backward differences in the time direction is stable for practical purposes.

179 pages. $2.24. MicA54-1410

ENGINEERING, METALLURGY

THEORY OF NODULAR GRAPHITE FORMATION IN DUCTILE CAST IRON

(Publication No. 8108)

Paul Herman Anderson, Ph. D.
University of Minnesota, 1954

A hypothesis is presented which takes into account the effect of surface energies involved in the formation of graphite nodules from carbon rejected from the iron melt, and which proposes that the crystallization of the graphite nodules occurs in the direction from the graphite-metal interface toward the nodule center.

This requires that the carbon from the unstable, undercooled liquid precipitate as a cloud of minute platelets. It is postulated that the platelets are only a few angstrom units across, and that they are only one carbon atom thick.

The platelets, behaving initially as flat carbon molecules, C_x, do not tend to be wetted by the melt, thus giving them an opportunity to agglomerate into spherical masses. During the time of agglomeration it is believed that the spherical masses of carbon assume the characteristics of a phase intermediate between the solute carbon and the crystalline graphite – mesoforms or liquid crystals. Evidence is presented, showing that this transition would account for both the nodular shape and the observed crystallographic orientation of the graphite.

Crystallization occurs at, or just under, the eutectic temperature when the mesoforms acquire crystalline regularity in all three dimensions. X-ray diffraction studies have indicated that numerous imperfections in the graphite crystals exist after solidification of the melt. Prolonged annealing at temperatures just under the eutectic temperature decreases the imperfections in the crystals by allowing a consolidation of the graphite to take place.

This is considered to be confirming evidence for the validity of the thesis.

67 pages. $1.00. MicA54-1411

DYNAMIC CREEP, STRESS-RUPTURE, FATIGUE PROPERTIES AND FRACTURE CHARACTERISTICS OF ROLLED ALUMINUM ALLOY 24S-T4 AT ELEVATED TEMPERATURES

(Publication No. 8116)

Fred William DeMoney, Ph. D.
University of Minnesota, 1954

Fatigue, stress-rupture, and creep data up to 100 hour life (2×10^7 cycles) obtained under six combinations of mean and alternating stress, including static stress and 100 per cent reversed stress, are presented and discussed for rolled aluminum alloy 24S-T4 at 300° and 500° F. The fatigue and stress-rupture data are presented as families of S-N curves, stress range diagrams and other plots to show the effect of temperature, alternating-to-mean ratio A, and stress magnitude on the fatigue and stress-rupture properties.

It is shown that the fatigue properties at 300° F are similar to those at room temperature, whereas at 500° F they are distinctly different. Superimposing alternating stress on mean stress reduces acutely the allowable mean stress at 300° F, while at 500° F superimposing alternating stress on mean stress up to ratio A = 0.89 does not greatly reduce the allowable mean stress.

The fatigue properties at 500° F are reduced for all ratios A, but those at low ratios A are reduced more than those at high ratios A. At 300° F the fatigue properties approximate the Goodman relationship whereas at 500° F they approximate a modified Gerber relationship.

The creep data are presented as total extension versus time curves, design curves which show allowable maximum stress for permissible total strains for certain times, and stress-range diagrams indicating the allowable combinations of stresses for various total strains and times. Two distinct types of creep curves are observed, a "static" (customary three stages of creep) and a "dynamic" (almost zero creep rate and very short third stage prior to rupture) type which appear to be functions of ratio A and temperature. The creep curves are graphically analysed with the result that at 300° F the creep is "static" at ratios A = 0 and 0.15, "dynamic" at A = 2.16 and ∞. At 500° F the creep is "static" at ratios A = 0, 0.15, 0.37, and 0.89 and "dynamic" at A = 2.16 and ∞.

In general, superimposing of alternating stress on mean stress affects creep in a manner similar to that observed in fatigue. At 300° F superimposing alternating stress on mean stress significantly decreases the allowable mean stress for a given creep. At 500° F this effect is considerably less pronounced.

The role of fatigue and creep as dual factors in rupture is discussed and appears to be a function of temperature and ratio A. As the temperature increases and the ratio A decreases, fatigue considerations become less important and creep factors predominate. A critical ratio A may exist at which these factors may have equal effect: at room temperature this ratio is about 0.08, at 300° F it is about 0.37, and at 500° F it is about 1.0.

Fracture surfaces of the ruptured specimens are presented and analysed on both a macro- and micro-basis. Fatigue nuclei, smooth fan-shaped areas, are observed in specimens at ratios A = 0.15 and higher at 300° F and at A = 0.89 and higher at 500° F. The size of the fatigue zone appears to increase with increasing ratio A at both temperatures. Metallographic analysis of representative fracture profiles indicate the mode of fracture to be transcrystalline at all ratios A at 500° F. These results are correlated with the creep-rupture data to substantiate the possible existence of the critical ratio A.

89 pages. $1.11. MicA54-1412

FINE ARTS

THE POETRY OF THOMAS MERTON: A STUDY IN THEORY, INFLUENCES, AND FORM

(Publication No. 8211)

Susan Margaret Campbell, Ph. D.
Stanford University, 1954

Thomas Merton is a minor twentieth-century poet who is beginning to have a major reputation. That there is need for a close study of his poetry is evident, on the one hand, from enthusiastic comments it has received in some reputable quarters, on the other hand, from a discrepancy which a few have noted between his method of writing and his undoubted sincerity. The purpose of this investigation is a critical evaluation of Merton's poetry, with special emphasis on his own poetic theory and on the influences which have affected his poetic practice.

The chief published works of this Trappist monk, converted to Catholicism in 1938, are four volumes of poetry: Thirty Poems (1944), A Man in the Divided Sea (1946), Figures for an Apocalypse (1947), and Tears of the Blind Lions (1949); two autobiographical works, The Seven Storey Mountain (1947) and The Sign of Jonas (1952); a history of the Cistercian Order, Waters of Siloe (1948); two treatises on mysticism and contemplation, Seeds of

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Contemplation (1949) and Ascent to Truth (1951); and finally, two spiritual biographies, Exile Ends in Glory (1947) and What are These Wounds? (1950).

The autobiographical works are significant in showing the development of Merton's ideas, taste, and interests concerning poetry. He has, however, a separate essay on poetry and contemplation in Figures for an Apocalypse. This essay attempts to analyze the likenesses and differences between the two, and, in doing so, the author sets forth certain principles by which he works and the problems that beset the work of one who is both poet and contemplative.

How Merton's theories have developed become clear in the light of theories of various poets and philosophers who have influenced him. William Blake is the first poet to affect Merton's thinking and Jacques Maritain is next in importance, since it was through this philosopher that Merton interpreted Blake. The other dominant influences are those of the Metaphysical Poets, Hopkins and Duns Scotus, and T. S. Eliot.

The body of Merton's poetry falls into four general headings: Secular, Religious, Nature, and Miscellaneous. An evaluation of the poems belonging to these groups show Merton to be the author of a derivative and highly mannered poetry, the form of which is often contradictory to the subject-matter, as well as to the philosophy and spirituality of the poet. This discrepancy seems to be due largely to an apparent acceptance of the general poetic theories of the Eliot-tradition, which requires that a poet be representative of his age, that he display an historical sense of poetry by imitating the poets of the past who most resemble the present, and that he consider poetry primarily a matter of the emotions.

Merton records in his most recently published book, The Sign of Jonas, that he is greatly dissatisfied with his poetry, but, not being able to analyze its deficiencies and trace them to their proper sources, he renounced the writing of poetry on March 20, 1949. It is the contention of the present author that if Merton were to forego writing according to the synthetic processes used by Eliot and his followers and apply to his poetic composition the same principles by which he has brought order into his life, the essential contradiction in his poetry would disappear. 340 pages. $4.25. MicA54-1413

WINTERWARD

(Publication No. 7576)

William Edgar Stafford, Ph. D.
State University of Iowa, 1954

Chairman: Professor Ray B. West

The poems collected here represent almost entirely work done in the Poetry Workshop at the State University of Iowa. Certain of them have appeared in The Nation, Poetry: a Magazine of Verse, The Western Review, The New Mexico Quarterly, The Western Humanities Review, and Experiment.

The collection does not have a consciously imposed pattern; however, the following doctrine, which has long appealed to the writer, may have exercised a perceptible influence:

> The human mind is capable of being excited without the application of gross and violent stimulants; and he must have a very faint perception of its beauty and dignity who does not know this, and who does not further know, that one being is elevated above another in proportion as he possesses this capability. It has therefore appeared to me, that to endeavor to produce or enlarge this capability is one of the best services in which, at any period, a Writer can be engaged; but . . . especially so at the present day.

This point of view has particular local application. The Workshop has sometimes induced in me a rivalry in the particulars of composition, and as a consequence the tendency of our time toward extreme effects in the poetic line has been enhanced. In other days a writer like Milton, for instance, preparing himself for great deeds in literature, sought that repose of mind and religiousness of purpose which in his opinion would eventuate in inspired creation, but our day has brought about competition for immediate and spectacular effects in pure poetry.

A harking back to Wordsworth and Milton for principles should not be taken to imply that the modern writer, including the workshop writer, is without principles. Typically, he shows relentless seriousness about particulars; tact with words requires a steady concern that indicates a high purpose. Current swagger and suspicion about the uttering of large general principles may be necessary in our time when, as Cocteau says, God to be served must be served in disguise. The contemporary project is to be noble though honest – a project with complexities for some of us.

As to techniques used in this collection, the writer is too near the creative process to be acutely aware of having relinquished any appropriate possibilities. The writing felt as if it took account of use of sounds, use of images, and use of "the dance of the intellect among words." Yes, these elements seem to be present; but of course the writer reads with a sympathy that is reciprocal to the urge that went into the writing. And that much sympathy the world might call partiality.

41 pages. $1.00. MicA54-1414

INVESTIGATION OF THE USE OF PLASTIC CONTAINERS FOR HEAT PROCESSED FOODS

(Publication No. 7852)

Kwoh Hsien Hu, Ph. D.
University of Illinois, 1954

The purpose of this study was to investigate the possibility of using plastic containers for heat processed foods. Mylar Polyester and Trithene were selected from seven plastic films of relatively high melting points. Both Mylar Polyester and Trithene films were used for heat stability and actual food packaging tests.

Heat stability of Mylar Polyester A and Trithene A as related to their water vapor permeability, gas permeability, and organic vapor permeability was determined.

Acid foods, such as applesauce and tomato juice were packaged in plastic bags for storage study. Applesauce packaged in both Mylar Polyester A and Trithene A developed a brownish black color after 5 to 7 days storage at room temperature. The addition of ascorbic acid to the applesauce packed in plastic film prevented the development of off-color and off-flavor during a 26-day storage period. Moreover, the regular applesauce packed in plastic film which was then enclosed in a tin can and the air space between the can and the plastic bag filled with applesauce showed no off-color and off-flavor development during the same storage period. This seemed to indicate that oxygen from the air, which permeated through the film, was the cause of color darkening and off-flavor development during the storage.

Tomato juice packaged in Mylar Polyester A 300 became darker in color than that packaged in Trithene A 400 after a 45-day storage period. This film packaged tomato juice placed in a tin can and surrounded with tomato juice yielded a much brighter red color than the film packaged juices exposed to air. This also seemed to indicate that the permeated oxygen from the air was the cause of color darkening of tomato juice.

Non-acid food, such as potato-meat stew, was packaged in plastic bags for storage study. In general, the potato-meat stew products were quite acceptable, both initially and after a 50-day storage period.

Club steaks were successfully packaged in Mylar Polyester A 300, processed, and stored at room temperature for demonstration purposes.

Heat penetration studies on non-acid food in plastic bags have been made.

82 pages. $1.03. MicA54-1415

SOME CARBOHYDRATE DERIVATIVES OF HIGHER FATTY ACIDS

(Publication No. 7863)

Huo-Ping Pan, Ph. D.
University of Illinois, 1954

In the present study an attempt was made to introduce one or more ortho-phosphoric acid groups into a saccharide and to esterify the remaining hydroxyl groups with one or more higher fatty acids. In previous attempts two methods have been used to synthesize a complex ester of a carbohydrate with ortho-phosphoric acid and fatty acid. One involved direct esterification of carbohydrate phosphates with fatty acid, and the other acylation of saccharide phosphate with the acid chloride of the corresponding fatty acids. However, neither method proved successful. Since we were interested in introducing phosphate on the carbohydrate part of the ester regardless of the number of the groups and their positions, a specific method was developed to prepare the esters by first phosphorylating a carbohydrate with phosphorus oxychloride and then directly acylating the compound with acid chloride. Water was eventually added to remove chloride ions.

The present results indicated that it was possible to prepare the fatty acid ester of a phosphorylated saccharides in three uninterrupted steps, namely, phosphorylation, acylation and hydrolyzation in pyridine as a solvent. As soon as the phosphorylation reaction had ceased, as indicated by a drop in temperature, the acylation process was carried out while the phosphorylated compound still remained in solution. In the syntheses of the esters by means of the uninterrupted phosphorylation, acylation and hydrolyzation process, the position of a phosphorylated group on the saccharide was not a directing one; the number of phosphate groups on the saccharide varied with the ratio of $POCl_3$ to the saccharide used during the reaction. Therefore, the product must be composed of a mixture of esters. The variety of esters in the mixture was further increased by acylation of the phosphorylated saccharide, as acylation might take place at any of the remaining hydroxyl groups. After the reaction ceased, the addition of water served to replace the chloride ions with hydroxyl groups, and hydrolyzed the excess $POCl_3$ and acyl chlorides in the ortho-phosphoric acid and the corresponding fatty acids.

In trying to fractionate each compound, both paper and column chromatographic methods were employed. Each sample of the compounds was developed with methyl alcohol, n-butyl alcohol, n-amyl alcohol and acetone-chloroform mixtures of different proportions, respectively, on No. 5 filter paper. The spot of the sample on filter paper was rendered

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

visible either by radiation with light of 3600 mμ or by spraying with bromcresol green solution.

The palmitoyl glucose phosphoric acid prepared with 3 mole equivalents of palmitoyl chloride was a crystalline compound with a sharp melting point and was free from both nitrogen and chlorine. A positive test with Benedict solution indicated that the aldehyde group was free and could react with 2,4-dinitrophenylhydrazine.

72 pages. $1.00. MicA54-1416

GEOGRAPHY

THE INDUSTRIAL ASPECTS OF ARGENTINA'S FIVE-YEAR PLAN: WHY IT DID NOT SUCCEED

(Publication No. 8225)

Ernest J. Wilkins, Ph. D.
Stanford University, 1954

The first Five-Year Plan in Argentina (1946-1951) outlined the basic re-organization of the nation's economic, social, and political life. The proposals of the chief executive with reference to industrialization may be summarized briefly as follows: 1) To increase production in all branches of industry with emphasis on certain critical raw materials and military requirements; 2) To establish a national steel industry using domestic coal and iron-ore, and create new industries in order to become self-sufficient; 3) To become self-sufficient in electrical energy by developing domestic sources of hydroelectric power; 4) To become self-sufficient in petroleum; and 5) To provide skilled laborers and technicians for industry and colonists to settle sparsely populated areas of the nation by encouraging immigration on a selective basis.

These self-sufficiency goals were established in direct response to the critical shortages experienced in Argentina especially during war-time and during periods of economic crisis when manufactured goods could not be imported.

The decision to sponsor industrialization at all costs led to the establishment of goals many of which were either impractical, too ambitious, or impossible of achievement because of technical difficulties. Projects were planned without taking into consideration the fundamental principles of economic geography.

Due to poor management, poor planning, and the highly irregular method employed to finance the Plan, there were insufficient funds to carry out all of its proposals. In going "all out" for manufacturing, the government neglected the nation's principal economic activities – agriculture and livestock raising. By 1949, it became necessary to curtail the program of industrialization and adopt a Three-Year Plan to aid farmers and increase agricultural production.

In order to be self-sufficient, the government decided to sponsor the production of pig iron from raw materials to be found within the country, an enterprise which had been considered unremunerative by private capitalists in Argentina. Nevertheless, the basic production of pig iron was forced under the Five-Year Plan. Production was handicapped by the inaccessibility and inadequacy of iron ore deposits, the complete lack of coking coal, and the fact that cheap transportation could not be used to assemble the raw materials or transport the finished product to market. Consequently, the domestic product cost considerably more than the imported equivalent. Production at the close of the five-year period was so small that it could be considered of negligible importance to the national economy.

The principal objectives of the hydroelectric program, which were to alleviate the fuel shortage and provide self-sufficiency in electrical energy, were not realized. The Five-Year Plan did not take into consideration the remote location of the great potential sites with respect to the industrial centers, and the practical limitations imposed on long distance transmission of power. Because of limited exploration and exploitation during the Five-Year Plan, self-sufficiency in petroleum was not achieved. In fact, due to increased consumption, Argentina appeared to be more, rather than less, dependent on imported petroleum at the close of the five-year period.

The government's scheme to acquire technicians, colonists, and new industries through selected immigration was equally unsuccessful. Immigrants chose to settle in large urban centers, while the concentration of manufacturing in Greater Buenos Aires continued largely as before. Decentralization still involved the dual problem of developing scant resources in the outlying regions and enticing workers to settle in these less desirable areas.

A majority of the production goals in light and non-durable goods were achieved during the Plan. However, the government failed to find and develop the natural resources and raw materials essential to the establishment of heavy industry. In spite of continued expansion and growth, manufacturing was still in the category of light industry at the conclusion of the Five-Year Plan.

261 pages. $3.26. MicA54-1417

GROUNDWATER MOTION AND ITS RELATION TO OIL ACCUMULATION

(Publication No. 8228)

Neal Lilburn Hurley, Ph. D.
Stanford University, 1953

Oil wells in numerous areas show the existence of tilted oil-water contacts at the base of petroleum accumulations. In association with these tilted contacts, the oil pools are often significantly displaced from positions predicted by the anticlinal theory of accumulation. From simple mechanical considerations, several petroleum geologists have derived equations relating the hydrodynamic potential gradient of groundwater flow in the reservoir rock with the tilt angle of the oil-water contacts. This dissertation describes the theory and application of methods for determining hydrodynamic gradients and water flow patterns in an artesian basin and considers in detail the equilibrium position of oil pools in such basins.

Fluid-mechanical studies are made of several hypothetical aquifers which crop out about the rim of an artesian basin. In the first case, an aquifer is assumed to be uniform in the transmissibility of fluid, to be bounded stratigraphically by impermeable aquicludes, and to be fully saturated by groundwater. Water from streams and surface seepage may enter and leave the aquifer only about the basin rim. Water in a well which penetrates the aquifer at any point in the basin will rise to a height of equilibrium which is proportional to the potential energy of the groundwater at that point. By connecting the heights to which water rises in wells throughout the basin, a smoothly undulated surface is formed which is termed the piezometric surface of the aquifer. The hydrodynamic potential gradient at any point in the basin will be equal to the slope of the piezometric surface at this point and will be in a direction perpendicular to the contour lines of the surface.

The piezometric surface height under these conditions represents a solution of the two-dimensional Laplace equation. If one specifies the piezometric height continuously about the basin rim from elevation measurements of the aquifer outcrop, the piezometric surface of the aquifer can be uniquely determined. Because of complexities of the problem, various approximation methods must be used, however. A numerical procedure for solving the Laplace equation called the relaxation method is described and applied to this case.

The height of a rubber membrane uniformly stretched over any irregular boundary satisfies the two-dimensional Laplace equation for small slopes of the membrane surface. Thus, the rubber membrane can be used as an analog for piezometric surface determinations.

Mathematical methods are given for approximating the piezometric surface when the aquifer does not crop out continuously about the basin. Relaxation and analog methods are also described for determining the piezometric surface when the aquifer is not bounded by strictly impermeable aquicludes. In the event that the fluid transmissibility of the aquifer is not uniform throughout the basin because of permeability and thickness variations or because of changes in the viscosity of groundwater, relaxation methods again must be used to solve the problem.

Having found the piezometric surface slope and hydrodynamic gradient at a place where a possible oil accumulation might exist, one may then determine the shape of the oil-water interface and thus find the equilibrium position of the oil pool with reference to the geologic structure. The petroleum accumulation represents an obstacle in the path of groundwater flow and forces the water to circulate around it. This distortion of the flow pattern will increase the piezometric surface slope and hydrodynamic gradient along the oil-water interface. In some cases, the distorted flow pattern will be such as to tilt the oil pool in a direction different from the regional hydrodynamic gradient. Thus, error will result from using the regional hydrodynamic gradient for calculating the oil-pool equilibrium position. Instead, one must consider the shape of each petroleum accumulation and note how the flow of groundwater and the hydrodynamic gradient are altered by this obstacle. Then the actual equilibrium position may be found.

164 pages. $2.05. MicA54-1418

STRATIGRAPHY AND STRUCTURE OF THE MESABI RANGE, MINNESOTA

(Publication No. 8147)

David Archer White, Ph. D.
University of Minnesota, 1954

The later Precambrian Animikie group in northeastern Minnesota consists of three sedimentary units: the Pokegama (quartzite), Biwabik (iron-rock), and Virginia (argillite) formations. "Mesabi range" designates the preglacial outcrop belt, one-fourth to 3 miles wide and 120 miles long, of the Biwabik formation.

Varieties of iron-rock ("taconite") are either granular or slaty and consist dominantly of chert, iron silicates, magnetite, and siderite.

The Lower Cherty, Lower Slaty, Upper Cherty, and Upper Slaty members of the Biwabik formation, which averages 600 feet in thickness, can be further subdivided as shown on a detailed longitudinal stratigraphic section. These members are fairly uniform

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

along most of the range, but only one cherty and one slaty member exist in the Westernmost Mesabi, where the lithic units are intertongued. The areal distribution of rock units on the Westernmost Mesabi is shown on a geologic map. The Biwabik, Pokegama, and Virginia formations are considered conformable. Mesabi rocks probably correlate with those of the Emily district 30 miles distant.

Chert, greenalite, minnesotaite, stilpnomelane, magnetite, some hematite, and siderite probably formed either during deposition or diagenesis. The rocks are essentially unmetamorphosed. The Pokegama and Biwabik formations were likely produced by the migration of a series of coexisting environments of deposition during an advance, a retreat, and a second advance of the Animikie sea. During the retreat, the deposits formed in successive environments from shore seaward were clastic material, carbonaceous-pyritic mud, chert-siderite, chert-magnetite, and iron silicate. Fine clastics of the Virginia formation, perhaps furnished by an outburst of volcanic activity, spread across the former environments of chemical sedimentation. Possible conditions of iron sedimentation were as follows: derivation of iron and silica by weathering of a low-lying land mass, perhaps under a CO_2-rich atmosphere and a seasonal climate; tectonic stability; and deposition in a shallow, quiescent epicontinental sea.

The Animikie beds strike about N 75° E and commonly dip 6-12° SE. A structure contour map on the base of the Biwabik formation shows numerous small anticlines, synclines, monoclines, and faults. Three major joint sets are present. The few rocks intrusive into the Biwabik formation include diabase sills, the Duluth gabbro, and the Aurora syenite sill. Contact metamorphism by the soda-rich Aurora sill has produced crocidolite in adjacent taconite. Minor internal folding of Animikie beds seemingly is more prevalent where the underlying rocks are volcanic or sedimentary rather than granitic.

The Mesabi range is covered by glacial drift which thickens southward, commonly from 20 to 200 feet, away from a ridge known as the Giants Range. Drift is as much as 500 feet thick over the Westernmost Mesabi. A map of the thickness of drift shows many drift-buried preglacial bedrock valleys that extend from notches in the Giants Range southward across the Mesabi range. Cretaceous iron-ore conglomerates, which at places overlie the Biwabik formation, occur as erosional remnants on bedrock ridges.

The scattered soft iron-ore bodies in the Biwabik formation are residual concentrates of oxidized iron minerals formed by the leaching of silica from chert and iron silicates in taconite. Conditions favoring ore concentration are thought to be as follows: accentuated fracturing at folds and faults allowing ready circulation of leaching solutions; a high iron content in taconite; solution-guiding by less pervious rock layers; reducing rather than oxidizing conditions of deposition of the original taconite; the fine grain size and intimate intermixing of different minerals; a lack of metamorphism which coarsens the grain; and the availability of large amounts of solutions. The soft ores may have been concentrated by downward-circulating ground waters.

215 pages. $2.69. MicA54-1419

HEALTH SCIENCES

HEALTH SCIENCES, NURSING

FACTORS RELATED TO SCHOOL DENTAL HYGIENISTS' POSITIONS IN CALIFORNIA

(Publication No. 8204)

March Kong Fong, Ed. D.
Stanford University, 1954

The Problem

This study investigated some of the possible factors related to the decrease in percentage of school dental hygienists choosing school positions in California. Although there has been a relative increase in the number of dental hygienists employed in school positions, this increase has been neither in proportion to the increase in total California dental hygienist population nor in proportion to the increase in total California school pupil population. This study sought answers to the questions:

1. Are dental hygienists rejecting school positions?
2. What reasons do dental hygienists give for rejecting or choosing school positions?
3. What reasons do student dental hygienists give for rejecting or choosing school positions?
4. Are training schools recruiting, selecting and training dental hygienists for school positions?
5. What is the availability of school positions in California?

Summary of the Study

Two hundred and twelve non-school-employed dental hygienists were mailed questionnaires requesting information on their present status and their reasons for choosing or rejecting a school position. These 212 dental hygienists were selected by taking every third name from an alphabetical listing of 636 dental hygienists registered with the California State Board of Dental Examiners at the time of this study (February, 1953). These 636 persons comprise the total California licensed dental hygienists' population at that time. One hundred and thirty-two (62.3 percent) of the questionnaires were returned. One

hundred and thirty-one of these dental hygienists gave their reasons for rejecting school positions. One dental hygienist reported that she preferred a school position. The three most frequently mentioned reasons for rejecting school positions were "low salary", "dislike for hours of work" and "lack of interest, appeal and satisfaction in that type of work". These data indicated that this group of dental hygienists largely rejected this type of work.

To supplement these data 36 school dental hygienists and 6 combination school and private practice dental hygienists were contacted for personal interviews relative to their opinions about their respective occupations. The 36 school and 6 combination school and private practice dental hygienists represented the total dental hygienists' population for these particular groups. The 58 private practice dental hygienists were selected from the non-school-employed dental hygienists residing or practicing in the areas in which school dental hygienists were located. Thirty-one school, 6 combination school and private practice and 32 private practice dental hygienists participated in this phase of the investigation. The private practice dental hygienists' sample reported the same reasons for rejecting a school position as did the correspondence sample. School dental hygienists mentioned "preference for the human relationships related to the work" most frequently as the reason for choosing a school position. The combination school and private practice dental hygienists reported that if limited to one type of work, they would choose the private practice position.

Seventy-six (97.4) percent) of the total California student dental hygienists' population provided information relative to their opinions about school and private practice positions. Seventy-five of the students reported that they were not interested in school positions. They mentioned "low salary" and "lack of interest appeal and satisfaction in that type of work" most frequently as reasons for rejecting that type of work.

California training schools reported no specific recruitment, selection or training program for school dental hygienists. A survey of the training programs indicated courses of study largely oriented toward private practice education.

Placement bureaus for dental hygienists reported a far larger number of private practice positions available over school positions. In each instance over 80 percent of the positions listed were private practice positions.

Conclusions

This study strongly suggests that the school dental hygienists' population in California may continue to decrease, percentage-wise. The indications are that, at present, school dental hygienists must be drawn from a population that largely rejects that type of work. The study pointed to needed research in determination of a policy regarding dental hygiene service in schools and possible consideration of training of special personnel to replace the school dental hygienist.

125 pages. $1.56. MicA54-1420

HISTORY

HISTORY, MEDIEVAL

THE RESPONSA OF RABBI GERSHOM BEN JUDAH ME'OR ha-GOLAH: AS A SOURCE OF THE HISTORY OF THE JEWS IN FRANCE AND GERMANY FROM THE SECOND HALF OF THE TENTH CENTURY TO THE FIRST HALF OF THE ELEVENTH

(Publication No. 6323)

Shlomo Eidelberg, D. H. L.
Yeshiva University, 1952

a. Statement of the Problem: Definition of Scope

The present thesis is a research of the history of the Jews in northern France and Germany in the second half of the tenth century to the first half of the eleventh century, based upon the works of Rabenu Gershom, Me'or Hagola (Mainz960-1028).

b. Methods of Procedure

This thesis is a careful study of scholarly literature from rabbinical sources from Rabenu Gershom's days till the first decade of the fourteenth century. Special consideration was also taken of the legal history of northern France and Germany of the beginning of the eleventh century.

c. The Sources of Data

Among the important sources used for this thesis are the following; manuscripts and incunabula from the tenth to the thirteenth century, which contain reminiscences of Rabenu Gershom, acts and records of the kings and bishops, records of the development of the town of Mainz in the early medieval period.

d. Summary of Findings

The works of Rabenu Gershom reflect the economic and social life of the jews of these times. The origin of the fundamental features of the organization of the later Jewish communities in Germany and Poland is to be found in the works of Rabenu Gershom.

e. Conclusions and Recommendations

This period is considered as a turning point in the evolution of the Jewish communities of Germany and northern France. Rabenu Gershom and his followers gave the impetus to this by laying the foundations. Further research should be initiated to uncover new manuscripts of Rabenu Gershom and his times. 285 pages. $3.56. MicA54-1421

HISTORY, MODERN

KARL MARX AND THE COMMUNIST MANIFESTO

(Publication No. 8215)

Elliot Erikson, Ph. D.
Stanford University, 1954

In some ways, the most significant document that Karl Marx ever wrote was the Communist Manifesto. It was the most widely read product of his pen, and while few understand the economic intricacies of Das Kapital, practically every socialist knows the slogans and battle cries of the Manifesto.

The background to the writing of the document is an interesting piece of history of modern revolutionary organization. Marx and Engels, after working out their theories of dialectic materialism, set to work to organize scattered revolutionaries into a tight international body. The new organization was to have centralized control, strict ideological conformity, and was to adopt the policies of organized propaganda, rather than premature plots for armed uprisings. The ideological conformity was to center itself in a doctrine of class struggle and hatred, rather than the abstract love which was the center of so many idealistic German philosophies of the time. When the Manifesto was written, Marx's ideas were triumphant.

The Manifesto itself sought to explain all history in terms of the class struggle and the march towards socialism, advocated the abolition of private property as the remedy for all social ills, and demanded radical democracy as the first step towards socialism. Communists, the Manifesto proclaimed, would aid democrats and socialists, but would keep their own identity. All attempts to ameliorate social conditions by partial reforms were thoroughly denounced.

In its historical logic, the Manifesto put too much stress on export trade as a factor in economic development, and in its political thought, overemphasized, perhaps, the importance of the property relationship. Nevertheless, the Manifesto remains one of the most significant and influential agitational tracts that have ever been put out.

285 pages. $3.56. MicA54-1422

CHARLES JENKINSON, LORD HAWKESBURY, AT THE COMMITTEE FOR TRADE, 1784-1792: A STUDY IN COMMERCIAL AND COLONIAL POLICY

(Publication No. 7790)

Charles Murray Johnston, Ph. D.
University of Pennsylvania, 1954

Supervisor: Dr. Holden Furber

In August 1786 a new British Committee of Council for Trade and Plantations was created by order-in-council. Charles Jenkinson, recently elevated to the peerage as Baron Hawkesbury, was selected to preside over the organization. Issues of a political nature as well as his aptitude for commercial matters were the decisive factors in Hawkesbury's appointment. He had commenced his political and administrative career as secretary to no less a personage than Lord Bute in 1761. Two years later he succeeded in securing the post of junior secretary at the Treasury where his zeal and obsequiousness commended him to his superiors. During the American War of Independence he served in yet another official capacity as Secretary at War, a position which gave him an insight into imperial problems and an opportunity to vent his spleen on the alleged ingratitude of the rebellious colonists.

Politically, Hawkesbury emerged as an esteemed member of the "King's Friends," a faction formed by Bute after 1760 whose avowed purpose was to support George III as the recognized architect of governments. A rapt student of Bute's political tactics, Hawkesbury in the decade of the 'eighties was regarded as the rightful heir to the leadership of the royal party. His standing in the political community was acknowledged in 1783 when the monarch sought his support to unseat the Fox-North coalition and to win the general election which, in the following year, firmly established the power of the new ministry of William Pitt. Furthering his political career all the while, Hawkesbury next served with some distinction in an ad hoc committee for trade convened in 1784. When Pitt subsequently formed the new Committee, with a staff of its own, two years later, he did not hesitate to call on Hawkesbury's services as president.

The Liverpool Papers in the British Museum reveal quite clearly that Hawkesbury never underestimated the duties of his office. Regarded by friend and foe alike as Mr. Pitt's "Commercial Minister," he left little to chance, it seems, in the management of Great Britain's economic policy. The board whose activities he supervised emerged as a competent executive department, as something of a "colonial office" in the inter-war years, 1786-1792. In these years it developed into a worthy successor to the old Board of Trade which had been dissolved in 1782. In his new capacity Hawkesbury sought expression for his own preconceived commercial notions and especially for his own philosophy of empire.

It was long maintained that despair and disillusionment characterized Britain's commercial and colonial policy in the years immediately following the American War. But certainly such sentiments did not prevail in the Committee meetings supervised

by the "Commercial Minister" after 1786. Indeed it seems that Hawkesbury made a substantial contribution to the revival of Britain's faith in empire. His own imperial philosophy was hardly new. He simply hoped to revive the old colonial system in its strictest sense and to extend it not only to the remaining British dominions in the New World but to the growing empire in the Eastern Seas.

Like the gloomy dean, Josiah Tucker, Hawkesbury and his chief clerk on the Committee, one George Chalmers, heartily opposed the further establishment of colonies of settlement per se. They preferred rather a purely commercial empire of trading stations and naval bases which would not constitute a drain on the material and human resources of the mother country. The activities of "John Company" in the Eastern Seas and the seizure of such vestibules of trade as the Cape of Good Hope squared neatly with the colonial policy cherished at the Committee for Trade. 190 pages. $2.38. MicA54-1423

THE AMERICAN PROTECTIVE ASSOCIATION: A STUDY OF ANTI-CATHOLICISM

(Publication No. 8097)

Donald Louis Kinzer, Ph. D.
University of Washington, 1954

Expressions of anti-Catholicism appeared from time to time in the years following the Civil War. Suspicious anti-Catholics generally pointed to three developments as the basis for their fears: (1) The appearance of a so-called Catholic vote; (2) The continuing controversy over the public schools, which involved discussions of the teaching of morality and the use of tax money in support of non-public institutions; and (3) A so-called Catholic influence over organized labor. The Democratic Party was usually regarded as subservient to Catholics, illustrated most often by references to the Irish-Democratic control of several large cities. President Grant's action in recommending a constitutional amendment to forbid use of public money for any sectarian purpose gave to the Republicans a reputation for favoring the anti-Catholic position.

Numerous nationalistic and patriotic societies were organized in this same period. Many of them included anti-Catholicism as one of the planks in their platforms. The American Protective Association, an oath-bound, secret, anti-Catholic organization with a membership open to both men and women, was organized on March 13, 1887, in Iowa. It was intended to have a nation-wide appeal and to take an active part in politics. The A. P. A. seemed to be a highly centralized society, but there was likelihood of local control in political decisions reached in its subordinate councils.

From its Mid-Western origin, the A. P. A. spread very slowly for the first five years of its existence. In each instance where its growth could be traced, it made its way as a part of the general anti-Catholic movement which was being expressed in several different groups which were seeking cooperation among themselves. Thriving on local issues, the A. P. A. spread through the Middle West, to the East Coast, and westward to the Rocky Mountain region and to the Pacific Coast. By 1893-1894, it had become a national organization. No considerable success was attained in the South, except in scattered instances. During 1893, the A. P. A. succeeded in becoming the accepted leader of all the anti-Catholic societies so that thereafter the "movement" was called by its initials.

Continuation of appropriations for contract mission schools on Indian reservations became an issue in the presidential election of 1892. On the issue, President Benjamin Harrison was regarded as an anti-Catholic. His defeat, coupled with state and local victories for Democrats in the Mid-West, illustrated for anti-Catholics the necessity for united political action. Thereafter the Republican Party was generally their political home. Congress terminated contract school appropriations during 1894 in an atmosphere which gave publicity and credit for the accomplishment to the A. P. A. The order thereupon concentrated on the congressional and state elections in the fall of 1894. Republican victories in these elections were publicized as "A. P. A. victories." In several state legislatures where A. P. A. dominance was claimed – those of Michigan, Minnesota, Washington, and Ohio – however, the order was not able to enact its program into law.

During the years of its success, the A. P. A. received publicity in newspapers and magazines. Its own propaganda methods were to use "ex-priests and ex-nuns" as speakers, to publicize allegedly anti-American pronouncements of Catholic leaders which were in reality A. P. A. forgeries, and to take advantage of local problems which involved Catholics or their institutions. Public concern with civic corruption, desire for immigration restriction, and other tendencies of the times provided the A. P. A. with an opportunity to ride popular currents of thought. Since it admitted foreign-born to its membership, the order appealed to non-Catholics of recent immigrant stock. A favorable press of nearly one hundred periodicals was developed to carry the message of the order to the public.

Charges of corruption and misuse of the order by its leadership made their appearance in the Mid-West shortly after the fall elections of 1894. A decline of membership set in there, while the order was still growing on the Pacific Coast. Internal dissensions and unfavorable publicity multiplied. A climax was reached during the order's national convention in May of 1896 over the issue of supporting William McKinley for nomination to the presidency. The A. P. A. split three ways during the convention: those who favored McKinley, those who favored choice of no candidate, and those who desired inauguration of a third party. The division led to so rapid a decline in importance that the A. P. A. was ignored by both Republicans and Democrats in their 1896 nominating conventions. In the election, some members supported McKinley; others supported Bryan.

Membership fell off rapidly and the "movement"

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

separated into its component parts. Until 1911, when its founder died, the A. P. A. continued a paper existence. In reality, the career of the order had always been a product of coincidence and fortuitousness. The legislation for which it received credit was not originated by it. Its function for either political party was to gain votes at a time when political decisions were made by narrow margins. Membership in the A. P. A. had always been given in exaggerated figures to give the appearance of success; when the order was put to a test, its influence turned out to be non-existent.

557 pages. $6.96. MicA54-1424

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

THE USE OF SCRIPTURE BY THE ENGLISH MYSTICS

(Publication No. 8214)

Sister Mary Eleanor Eaton, Ph. D.
Stanford University, 1954

The chief English mystics of the fourteenth century – Richard Rolle, the anonymous author of The Cloud of Unknowing, Walter Hilton, and Julian of Norwich – all use biblical texts and allusions in in their prose in accordance with the exegetical methods of their period.

The present study opens, therefore, with a somewhat extensive survey of the exegetical tradition represented in these early devotional writers. Further background information is then supplied concerning the history of biblical translation in England and the sources of their mystical doctrine. Detailed examination of the works of the English mystics follows.

Scriptural inspiration is basic to both the Latin and the English works of Richard Rolle, the first of the English mystical group. In his early years he wrote a considerable amount of Latin scriptural commentary, and later he produced the English translation of the Psalter, with its accompanying commentary. The short English prose pieces of his last years show the effect of his pre-occupation with Scripture. Here the use of vernacular quotations exhibits the role of the biblical text as a stimulating factor for the development of his thought. Moreover, the unobtrusive art with which Rolle weaves Scripture into his prose gives evidence of a mastery of biblical idiom.

The author of The Cloud of Unknowing shows himself well versed in Scripture and its methods of interpretation. Direct quotations are few, for he explicitly repudiates citation of authorities, scriptural or otherwise, as a practice so overworked as to be meaningless. For this very reason his use of biblical phraseology, of examples drawn from Scripture, and occasionally of direct quotations interpreted spiritually has added value in demonstrating the unique place which the Bible holds in the mind of this highly original author.

Far more extensive use of scriptural quotation is found in Walter Hilton than in the other English mystics. The Scale of Perfection is studded with scriptural texts, usually given first in Latin and then in an English translation which often includes paraphrased matter interpreting the quotation suitably to its context. The Scale illustrates nearly every phase of the medieval use of the Bible. Examples of the employment of each of the four senses of Scripture are readily found. Tropological and anagogical interpretations naturally predominate in a work of this kind. The use of concatenation of texts and of verbal concordance shows Hilton's acquaintance with the techniques of the university sermon. The ease with which he employs biblical texts in the vernacular confirms other evidence that such a practice was common in the fourteenth century.

Meditative use of the Bible, especially of the Pauline Epistles, is illustrated in the Revelations of Julian of Norwich. Verbal echoes of passages of Scripture indicate Julian's familiarity with the Bible – although she professes herself unlettered. She is witness to the carry-over of the biblical learning of the spiritual masters of the age into the thought and language of their followers.

The deeply traditional character of the learning and doctrine of the English mystics is, then, clearly discernible in their use of Scripture. Their originality lies in their adaptation of traditional material to the needs of a growing public literate only in the mother tongue. Their skillful handling of texts in the vernacular and their constant employment of biblical language and imagery may thus be seen as valuable testimony to the strength of biblical influence upon English devotional prose in the fourteenth century.

337 pages. $4.21. MicA54-1425

ST. EVREMOND IN THE FRENCH AND ENGLISH CRITICAL TRADITIONS

(Publication No. 8216)

Jack Elliot Fink, Ph. D.
Stanford University, 1954

Though little known today, Charles de St. Evremond (1616-1703) was highly respected as an author and as a critic in both France and England during the seventeenth century. A re-examination of his work

reveals a liberalism, a perceptiveness, and an independence of judgment which entitle him to a more eminent place in the history of literary criticism than he has been generally accorded. His attacks on the neo-classical rules, on Aristotle, on the French Academy, and his advocacy of an historico-relative approach to literature in an age of subservience to what many critics considered the immutable literary canons of the ancients helped to liberalize French and English neo-classical critical theory. As a leader in the School of Taste and a champion of the theory of milieu and climate as formative influences in literature, he contributed further to freeing writers from the shackles of authoritarian criticism. After his exile from France in the latter half of his life, he occupied a distinguished position in the social and intellectual life of England which enabled him to become one of the chief purveyors of French literary ideas there.

His influence on English criticism was more profound than has been generally realized. He was one of the few critics in England – there were none in France – to recognize the merit of Elizabethan tragedy. His praise too of Elizabethan comedy when chiefly foreign models were being emulated did much to re-affirm the native tradition in drama. Three critics – Dryden, Dennis, and Temple – show the clearest evidence of the influence of his ideas, especially in the area of historico-relative criticism. Dryden expressed great admiration for St. Evremond, and there is a remarkable critical rapport between them on such matters as the relative merits of the ancients and moderns, the superiority of liberal to literal translation, and the worth of English comedy. It is not surprising then that Dryden should have drawn on St. Evremond for confirmation of his ideas on the role of admiration in tragedy, the invalidity of Aristotle's doctrine of catharsis, and Racine's violation of historical verisimilitude in depicting Greek heroes as French courtiers. Dennis likewise greatly admired St. Evremond and frequently quoted him. The Frenchman's ideas are most clearly evident in Dennis' historico-relativism, in his support of the moderns, in his emphasis on the effect of climate on character, and in his high regard for English comedy. It is more difficult to determine how much Dennis drew on St. Evremond for a number of other ideas which the two critics held in common, such as that of the pragmatic test of art or that of the propriety of love as a motif in tragedy, though the presumption of influence in the latter instance is strong because St. Evremond was virtually alone among the critics in advocating love as a dramatic theme. The third critic to have been greatly influenced by St. Evremond was Temple. A remarkable similarity in taste and general philosophy was conducive to an easy assimilation of St. Evremond's critical ideas by the Englishman. Through St. Evremond Temple became interested in the Quarrel of the Ancients and the Moderns and in turn precipitated the literary phase of the Quarrel in England. St. Evremond's influence is evident also in Temple's historico-relative approach to literature, his disavowal of the rules, and his recognition of the merit of English comedy. His singular admiration for Epicurus when that philosopher was generally despised and his enthusiasm for Don Quixote, whose fervid admirers were few, likewise can be traced to St. Evremond. It is one of the paradoxes of literary history that a man who could not even speak English should have done so much to shape the literary theories of the country to which he fled in exile. 248 pages. $3.10. MicA54-1426

THE EDUCATION OF HENRY THOREAU, HARVARD 1833-1837

(Publication No. 8077)

Christian P. Gruber, Ph. D.
Princeton University, 1953

In The Education of Henry Thoreau, Harvard, 1833-1837, I attempt to show clearly Thoreau's indebtedness to his Harvard education. I trace his intellectual development from a proud, independent boy to an equally proud, independent young man full of those ideas and ideals absorbed during four years at Cambridge and equipped by his training there to express those ideas with candor and vigor. In tracing this development I have underscored the positive contributions of the Harvard system – its teachers, teaching methods, curriculum, and the less formal but very important contributions provided by his fellow students.

The subject is divided into eight chapters. The sequence of these chapters reflects two coordinated principles of organization. Material is organized chronologically within chapters; the chapters are arranged in the order of their importance. The first chapter describes the Concord boy who first came to Harvard in 1833; the second chapter describes the Harvard system of education to which Thoreau was exposed for four years; the third chapter describes those class mates with whom he was most intimately associated and the social and intellectual experience they shared with Thoreau; the fourth chapter describes the religious and philosophical studies available and their generally negative impact upon Thoreau; the fifth chapter describes the classics studied and their lasting influence on him; the sixth chapter describes the mathematical and scientific training and its often surprising contributions to Thoreau's later prose; the seventh chapter describes the religious and social thought to which Orestes Brownson exposed Thoreau in 1836; the eighth and final chapter describes the rhetorical training under Edward Tyrrel Channing.

In general the dissertation supports the thesis that Thoreau's debt to the liberal education he received at Harvard was greater than has generally been acknowledged and that Emerson was very correct in saying that Thoreau's "debt to [college] was important."

285 pages. $3.56. MicA54-1427

THE GRASS ROOTS OF UTOPIA: A STUDY OF THE LITERATURE OF THE AGRARIAN REVOLT IN AMERICA, 1880-1902

(Publication No. 8123)

Clinton Clarence Keeler, Ph. D.
University of Minnesota, 1954

While previous works have examined the political and economic history of the agrarian revolt, this study proposes to analyze the imaginative expression of the movement in fiction, campaign pamphlets, newspaper doggerel, and speeches. Farmers in their Alliances, the Knights of Labor, Christian Socialists, Single Taxers, Coxeyites, and Feminists were reading and discussing a common body of reform literature.

In this analysis of the imaginative literature the term symbol designates an image which blends concept and emotion. An examination of the hero as farmer shows that the vitality of the symbol springs largely from the traditional conception of the Jeffersonian husbandman. Authors like Hamlin Garland and C. C. Post tried to describe the real plight of the farmer during the hard times of the 1880's and 1890's, as opposed to the idealized tradition. Yet their commitment to contradictory assumptions like the eighteenth century rationalist views of benevolent nature, the idea of purposive evolution in nature, and that of an indifferent or even hostile nature demonstrates disagreement as to what the farmers real plight was.

In depicting the hero as politician these writers intended to illustrate the same faith in strong governmental action that their political platform implied. But their writings reveal a persistent belief that strong government leads inevitably to corruption. Their heavy dependence upon the deus ex machina of the heroine in the sentimental tradition to rescue the hero from the iniquities of politics substantiates this. Also, deletion of the legitimate folk qualities in the symbols of their writing suggests a feeling of a need for status.

The hero as mechanic usually emerges from a rural background. Although the agrarian reformers looked for a basis of unity with urban labor, fictional material treats the laborer as a pilgrim en route to proprietorship, especially in land. Amost never is the laborer treated simply as wage-laborer.

The merchant is attacked vigorously in works like H. O. Morris's Waiting for the Signal and Douglas McCallum's The Dogs and the Fleas. The usurer provided a pejorative symbol for the merchant about which nearly every one of the reform groups could agree. Yet evidence of admiration for the meliorative symbol, "the merchant prince," is sometimes seen. The corporation in its legal status as person was unassimilable in the agrarian modes of thought; for these writings rested, often without the author's conscious intent, upon a world view of natural rights and moral law which demanded individual responsibility. In the cooperative the agrarians found a concept which sheltered the individual yeoman farmer, yet operated as a competing pressure group among other groups.

The heroine of this fiction is apotheosized even beyond the tradition of the sentimental novel. This emphasis upon the social and political power of the virtue of woman reflects partly the attitudes of the feminists, partly the traditional novel form, and partly the intensity of the emotion behind the reform which was seldom objectified in an appropriate reform symbol – such as the prairie wife.

Outstanding in this literature is the evidence of a deeply-desired unity in the symbols of the popular imagination. The reformers felt that popular government, the basis of all their proposals, must depend upon a community of belief. One set of beliefs centered in the mythology of primitivism, but another centered in the mythology of utopian progress. The intensity of the search for unity is reflected in the religious symbolism – the "religion of humanity." In the gulf separating the dream of anarchic primitivism from the dream of utopian progress we see the American folk pursuing their unending quest for brotherhood. 292 pages. $3.65. MicA54-1428

THE PLACE OF THE MINOR ITALIAN POETS IN THE WORKS OF RONSARD AND DU BELLAY

(Publication No. 8161)

Bodo L. O. Richter, Ph. D.
University of Pennsylvania, 1951

Supervisor: George O. Seiver

The purpose of this study is to determine both the amount and the method of Ronsard's and du Bellay's borrowings from minor Italian sources. The Italian poets under consideration are primarily those represented in the Petrarchistic anthologies of Rime diverse, the most important of which were published by Gabriel Giolito in Venice between 1545 and 1549.

Following a suggestion by H. Vaganay – that a more detailed bibliographical investigation of these volumes should be undertaken – I have devoted my first chapter to this task. Nine photostatic reproductions – most of them taken from books in the University of Pennsylvania Library – were added as documentary evidence.

The ulterior purpose of these bibliographical data was to lay a firm foundation for a copy of the first two books of Rime diverse which were in the possession of Ronsard. Ronsard owned and annotated the second edition of the Libro primo (1546), and the second edition of the Libro secondo (1548). As Ronsard's handwritten observations have never been studied in detail, this has been done, with the result that new light could be shed not only on du Bellay's borrowings from the "quelques modernes Italiens" whom he did not deign to mention by name, but also on Ronsard's background as a reader of classical and Italian literature. As several of his references are not clearly written or faulty, fourteen more photostats have been prepared on the basis of a microfilm of Ronsard's volume, the original of which is now in the Bibliothèque Nationale.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Ronsard's annotations and markings tell us considerably more about du Bellay's borrowings than about his own. The name "Bellay" appears fifteen times in the margin, mainly of the Libro primo. The sonnets thus singled out all made more or less obvious contributions to the Olive, including one which has escaped the attention of J. Vianey and H. Chamard (Olive, sonnet CIX, "Pere du ciel," is a direct imitation of Bembo's "Alto Re," Libro primo, p. 20).

In the survey of the amount of imitation, all the poetic works of Ronsard and du Bellay have been considered, but the method has been interpreted chiefly on the basis of the most outspokenly Petrarchan "canzoniere" of each poet: the Olive (1549-1550), and the Amours (1552-1553).

Besides du Bellay's pronounced predilection for minor Italian sources, well-known since the studies of Vianey, it has been found that the author of the Deffence is most successful when he follows closely the Italian original, and that his "translations" generally are more accomplished than his free imitations. Ronsard did not score a faithful adherence to the original, but in these instances the master of the Pléiade preferred Petrarch and his most devoted disciple, Bembo, to the minor figures. Ronsard's imitations are more fragmentary than those of his friend who was less interested in single themes and expressions than in a whole sonnet, or the compression or expansion of one or several stanzas. Ronsard often remains faithful to a motif or image that has attracted him, while du Bellay moves on to new material, no doubt because the concealment of his sources was an active consideration for him.

Of special interest is the handling of the conclusion of the sonnets, the final epigrammatic pointe, which is often the most personal part of an adaptation by du Bellay (as in "L'Idée"), while Ronsard, who leans towards Petrarch especially in the second tercet, is often too strongly imitative in the corresponding portion of his poem.

The personal trait in du Bellay's sonnets is commanded either by a feeling for nature, Neo-Platonic ideas, or a satirical vein. Ronsard departs from his models most frequently in order to make room for a mythological excursus or a sensualistic vision which was suggested to him by Ariosto, rather than by Petrarch or his equally reserved imitators. Both Ronsard and du Bellay use freely the rhetorical devices of the Petrarchists, and it is this aspect of their borrowings which was the least in harmony with their own creative talents.

340 pages. $4.25. MicA54-1429

LANGUAGE AND LITERATURE, MODERN

FIGHTER AGAINST LOSS: THE HEMINGWAY HERO

(Publication No. 8210)

Sydney Ralph Bobb, Ph. D.
Stanford University, 1954

If we define the Hemingway hero as the adult male protagonist whose basic action Hemingway endorses, we will discover that this hero is a man who loses, fights with skill and intelligence, and enjoys, manifesting some code of conduct the while, in an alien environment within a hostile universe.

The more important the fact of loss, the more personally hostile the universe; after the first novels, Hemingway focuses his attention not on the fact that loss exists, but on how to meet it. Hemingway does not grow in his concept of the conditions of life; he merely shifts emphasis. The concept does not rest on a powerful coherent system of thought.

Fighting is Hemingway's central theme; courage-in-action his highest value. Intelligence exists in order immediately to be transformed into action. The hero has free will, retains his full potential as a fighter, and fights alone, almost daily, for a cause.

Hemingway confuses two senses of "good" – moral and competent; back of the confusion is sex. However, in his last two novels, he has become more of a teacher of the young than ever before. This didactic content is connected with a relative absence of the formal element of discovery.

The artistic problem of the proportionate relation of the hero to other elements in the work Hemingway never completely solves in any of his full-length novels. 218 pages. $2.73. MicA54-1430

PRINCIPLES GOVERNING AFFINITY BETWEEN THE MEMBERS OF INTERVOCALIC PAIRS OF CONSONANTS IN FRENCH

(Publication No. 8159)

Frederick Daniel Eddy, Ph. D.
University of Pennsylvania, 1951

Supervisor: Pierre DeLattre

This dissertation in experimental phonetics consists of 284 double-spaced typewritten pages. It includes a Chart (unfolded, about 24 x 30 inches), 5 plates, and 22 statistical tables.

There follows a brief summary of the content of each of the 7 chapters.

Chapter 1. Introduction. Consonant affinity is defined as the ease with which two consonant articulations are pronounced together, i. e., the facility with which their articulations unite or combine. The purpose of the study is to discover what physiological laws or principles determine the affinity between the members of intervocalic pairs of consonants in

French. For example, the affinity between /d/ and /m/ in à demain, or in the artificial combination /adma/.

The problem is attacked by performing two general operations having respectively the following objectives:

First, by using various techniques, to establish an Index of Affinity that measures on a common scale the affinity existing in all possible intervocalic consonant pairs. This Index is found on the Chart that accompanies the text.

Second, by general inspection of the Chart, by detailed comparison of its various areas and individual cases, and by using such knowledge as we have of the physiology of speech, to deduce the physiological principles that govern affinity.

Chapter 2. Some Historical and Comparative Considerations. Briefly discussed here are the elimination of all but a few consonant groups in Old French, and their reappearance since about 1300. French is summarily compared with other Romance languages and with Germanic languages as to consonant groups.

Chapter 3. The Body of Information Now Available on Consonant Affinity. Considerable material exists, but apparently this is the first complete study of the subject. It organizes what has been previously written, corrects it here and there, and adds a considerable amount of new material.

Chapter 4. Description of this Study. An epenthetic sound appearing between the members of the consonant pair indicates lack of affinity. Its measurement on about 2900 kymograms and 250 spectrograms provides the Index of Affinity appearing on the Chart. Explanation of: Theory of recordings used, Techniques of recording, Techniques of measurement, Techniques of calculation.

Chapter 5. First or General Principles Governing Affinity. First principles involve all cases on the Chart and have high overall validity (80% or more). They are: 1) Force of Articulation: the greater the force – of either consonant, or both – the greater the affinity; and 2) Similarity of Mode: whenever the mode of articulation of both consonants is the same, affinity is greater than when their modes are different.

Chapter 6. Second Principles Governing Affinity. Occasional Mechanisms. Second principles affect fewer than all cases and have relatively low validity (about 40% to 60%). Occasional Mechanisms bring, or give evidence of, affinity in a very limited number of cases. There are also certain minor factors apparently having some slight influence on affinity.

Second principles: Affinity is greater when the articulations are made

1. with the same organ
2. at the same or near points, or in the same area
3. with the consonant of greater aperture coming first in the pair
4. in the case of 2 stops, in front-to-back order; in the case of two continuants, in back-to-front order (100% valid)

Occasional Mechanisms:

1. Overlapping
2. Epenthesis of an embryo stop
3. The semi-stop (stop plus fricative)
4. Nasal explosion of oral stops

Chapter 7. Conclusion. A recapitulation and summary of all factors bringing affinity, as established in Chapters 1 through 6.

298 pages. $3.73. MicA54-1431

SULLY PRUDHOMME; AN INTELLECTUAL BIOGRAPHY: A STRUGGLE FOR IDEALISTIC RECONSTRUCTION IN THE AGE OF POSITIVISM

(Publication No. 8195)

Clyde William Eichel, Jr., Ph. D.
Cornell University, 1954

This study is a comprehensive analysis of Sully Prudhomme's intellectual system, considering the distinguishing features of its origin and development and also viewing it in relation to the current of ideas of the period in which it evolved. It differs from earlier works dealing with him by presenting his prose and poetry concerned with a given philosophical problem simultaneously instead of considering them as separate, unrelated entities, which usually results in the complete ignoring of his rather recondite prose writings. To ascertain the nature of Sully Prudhomme's intellectual evolution, we have strictly adhered to the chronological order of the composition of his works in presenting them for consideration. The exposition of the poet's scientific ideas and the discussion of their relation to his ethical theories is a new contribution of this work, and it also offers the first evolutionary study of his thinking on government and social organization.

Although Sully Prudhomme alone among French literary men of his day (c.1870-1890) received a scientific education, and although his thinking bears the deep imprint of the then-dominant scientific doctrines of Positivism and Evolution, it repeatedly gives evidence of being an idealistic reaction to the materialism and determinism of the period. Even in his scientific essays, he seeks to maintain two traditional ideas he believed necessary for the preservation of human dignity – the separation of the psychic and physical worlds and the affirmation of Freedom of the Will. His preoccupation with moral principles is especially notable at the time when other philosophers such as Nietzsche and Haeckel were attacking and undermining the age-old association between philosophy and ethics. The Theory of Evolution with its corollary of Survival of the Fittest seemed to depict external nature as a world of ceaseless strife – a view which could only appall such humanitarians as the poet. The compassionate reflections on human unhappiness that fill his early sonnets appear about to succumb to despondent pessimism in the first part of La Justice, which marks a climax of his despair,

induced by materialistic theories. Yet when he renounces all hope of finding evidences of justice and love in the outer world, he finds an inner seat of moral authority in conscience and the moral insights of the human heart. All his later prose and poetic works seek to exalt the mystic rights of this super-rational faculty, designated (in Pascalian vein) coeur. The glorification of the subjective faculty of conscience is anti-scientific. Another liberty he takes with scientifically verifiable criteria is the setting of the epic Le Bonheur in the afterlife. Sully Prudhomme's purportedly scientific works do not employ the methods of observation and induction but recall Descartes and Spinoza by their abstract, deductive arguments. Thus, the poet moved away from purely scientific ideas rather than toward them, as is commonly believed.

The poet's social thinking emphasizes cooperation and, secondarily, a greater measure of justice to the working classes, but completely fails to perceive the economic basis of social tensions, viewing them as a purely moral problem. His philosophy of history continues the melioristic tradition of Montesquieu.

Throughout his poetry, Sully Prudhomme shows great interest in Neo-Platonic speculations concerning immortality and the transmigration of souls, which foreshadows Le Bonheur. However, he has little interest in the Nature of God, and the absence of a logically-necessary Deity from La Justice and Le Bonheur renders them colorless and unconvincing.

Inasmuch as Sully Prudhomme's thinking on science, political theory and religion is now obsolete, his shorter poems exhorting his readers to tenderness and pity seem to have the greatest relevance and the most secure hope of immortality at the present time. 351 pages. $4.39. MicA54-1432

HOFMANNSTHAL ALS KRITIKER DER DEUTSCHEN LITERATUR

(Publication No. 7236)

Ivar Vidrik Ivask, Ph.D.
University of Minnesota, 1953

The Austrian writer Hugo von Hofmannsthal (1874-1929) is primarily known for his poetry, stories, plays (the libretti for Richard Strauss' operas) as well as for the first Salzburg Festivals, which he organized. All these aspects of his rich and many-sided work have been already – more or less satisfactorily – analysed (Chapter I gives a general survey of the state of Hofmannsthal-research). Less attention has been paid by the critics to his essays, which form an important and integral part of his literary output and hold a prominent place in the development of modern German criticism (Chapter II surveys the few competent appraisals of the essays, such as those by Borchardt, Curtius, Rychner, Naef and Milch). The object of the present thesis is to throw light on Hofmannsthal's critical activities and to establish him in the tradition of German criticism.

Hofmannsthal possessed first-hand knowledge of all the great European literatures, especially in the Romance field, since he obtained his Doctor's degree in the field of Romance philology in 1899. A number of essays in the four volumes of his collected prose – "Prosa I-IV" of the new fourteen-volume edition of his complete works – are a testimony to this erudition and his unflagging interest. Hofmannsthal's critical ability can also be observed in his excellent anthologies, which are the practical application of his concept of the German "Great Century" (1750-1850). The present thesis has utilized the above sources along with critical passages in the poet's notebooks and letters (particularly in the last section of Chapter IV that deals with his criticism of his contemporaries). Hofmannsthal issued in his later years a literary quarterly, "Neue deutsche Beiträge" (1922-1927), and participated in the program of the "Verlag der Bremer Presse." The author of the present thesis had at his disposal for this significant period the unpublished correspondence between Hofmannsthal and the director of the aforementioned publishing house.

In the presentation of Hofmannsthal's criticism an attempt has been made already in Chapter I to classify the various prose-forms hidden behind the misleading and rather vague term of "Prosa"; here the actual "Critical Prose" was separated from the rest. Chapter III goes one step further and classifies the forms of the "Critical Prose," which consists of essays, prefaces, introductions to the poet's own anthologies and publications, speeches, book-reviews, open letters, and imaginary conversations. This critical activity runs parallel to Hofmannsthal's creative work (1892-1929). We can distinguish three phases in this activity. A first one from 1892 to 1901, which consists primarily of book-reviews, a second from 1901-1911, which is dominated by imaginary conversations of an impressionistic-intuitive type of criticism, and a third phase from 1911-1929 that contains Hofmannsthal's mature interpretative criticism. (However, there are some significant exceptions to this classification, e.g., "Gedichte von Stefan George" 1896, "Victor Hugo" 1901, "Wilhelm Meister in der Urform" 1911).

The remainder of Chapter III deals with the methodical foundations of Hofmannsthal's literary criticism. His thoughts on language, style, form, poetry, narrative prose, drama, and his use of the terms "Gegenwart" and "Tradition" are discussed. Then the analysis centers on the importance of Austrian and French literature for Hofmannsthal's criticism of German letters. The conclusion of this chapter is that Hofmannsthal employs alternatively three different methods in his best essays: the stylistic, the historic, and the methods of "Geistesgeschichte" (e.g., "Victor Hugo," "C. F. Meyers Gedichte").

Chapter IV presents Hofmannsthal's practical achievement as a critic of German literature. He covers in his essays the period from the 18th century (Lessing) to contemporary literature (up to 1929). They contain many new evaluations and re-discoveries (Heinse, Immermann, J.v. Müller). The German authors Hofmannsthal has discussed most frequently

are Goethe, Schiller, Grillparzer, George, and R. A. Schröder.

Chapter V sums up the previous investigations by determining the place of Hofmannsthal in the History of German criticism and points out his considerable influence on a number of contemporary German critics, the so-called "Traditionalists" in particular.

462 pages. $5.78. MicA54-1433

DAS LIEBES- UND TODESPROBLEM BEI JOHANN CHRISTIAN GÜNTHER. (THE PROBLEM OF LOVE AND DEATH IN THE WORKS OF JOHANN CHRISTIAN GÜNTHER)

(Publication No. 7806)

Hans Wilhelm Munzer, Ph. D.
University of Pennsylvania, 1951

Supervisor: Ernst Jockers

Love and death are inseparably linked in organic existence, they represent the positive and negative aspects of the same biological fact. The individual's instinct of survival rebels against this fact. The psychological tension thus engendered can be (1) overcome by religious faith in another – eternal – life after death, (2) artificially suppressed and temporarily banished from consciousness by sensual intoxication, and (3) mastered by the philosophical belief in the indestructibility of the thinking mind. Around 1700, Lutheran-Orthodox and Pietistic Christianity, sensualism, and rationalism coexist in Protestant Germany, unable to merge. Each one of these forces develops its own poetry, in which it proclaims its particular concept of love and death.

The poet Johann Christian Günther finds himself in the midst of this situation. His tremendous sensitivity subjects his entire personality to one prevailing emotion, while his innate poetic genius enables him to create lyric poetry that reflects his emotions, i. e., historically speaking, he blends the three hitherto separate currents of poetry into a unique unity of experience. In his love for Leonore Jachmann, his Schweidnitz sweetheart, the three older concepts of love merge. The power of worldly love temporarily solves his death problem by secular means, but the synthesis so attained disintegrates with the end of this love. First the sensual component of love appears separately in the love affairs with Rosette and the "Leipziger" Leonore, in the former in Anacreontic conventionalization, in the latter naturalistically and esthetically tinged. The rationalistic concept of love is embodied in two further love experiences. In his relationship with Phyllis Günther attempts a sensible integration of love and marriage into a life consciously molded by rationalistic moderation and middle-class industriousness, while his relations with Eleonore Dauling only constitute an intellectual friendship, a conjugal union being completely impossible. Nowhere in these relationships was Günther permanently successful, and nowhere was love, weakened by its loss of synthesis, capable of renewing the solution of the death problem attained in Günther's relations with Leonore Jachmann. Günther's life, though restless and confused in many respects, shows three remarkably consistent trends: The importance and might of worldly love decrease steadily, his awareness of the harshness and cruelty of life constantly increases, as does his yearning for death. During the Leipzig period (1717-1719), love as a means of conquering death is supplemented by Günther's immortal fame as a poet and by "science" (i. e., philosophy), while from 1720 onward his yearning for death prevails to such a degree that conquest of death by secular means no longer is even desired. Thus Günther again turns to the religious solution of the death problem suggested by his inherited faith. In contrast to his early religion Günther's late religiousness is no longer ecclesiastically determined but purely individual, being a peculiar mixture of Lutheran, Pietistic, and strictly personal concepts and feelings. A special characteristic of this individual religiousness is his ever-growing awareness of original sin, which his increasingly introverted mind interprets as a personal guilt, for whose expiation he alone is responsible. With scrupulous self-examination he passes through every stage of Christian purification, until, towards the end of his life, he embraces Christ, who, on a higher plane, no longer insecure, grants him the synthesis and conquest of death attained only temporarily in his love of Leonore. Though shipwrecked in life, Günther masters death through his love of Jesus.

The problem of love and death in Günther is the existential problem of modern, occidental man, who in his individualism submits to no authority. Günther's poetry as a whole is therefore in its own way a precursor – however modest – of the most comprehensive work dealing with this problem: Goethe's "Faust."

242 pages. $3.03. MicA54-1434

BLAKE'S DOCTRINE OF CONTRARIES: A STUDY IN VISIONARY METAPHYSICS

(Publication No. 8132)

Martin Karl Nurmi, Ph. D.
University of Minnesota, 1954

This study is an attempt to delineate the main features of Blake's doctrine of contraries and to show the role it plays in some of his works. The first chapter gives an account of Blake as a philosophical poet and sketches in those of Blake's ideas which are related to his doctrine of contraries; it is concerned especially with his humanism and his doctrine of perception. The second chapter is an exposition of the chief features of the doctrine of contraries itself. It shows that Blake conceives of the contraries as opposed but complementary immanences which inform with a dynamic, creative (though not necessarily progressive) tension the "real" and "human" existence that is perceived by the visionary imagination. Chapter iii compares and contrasts the doctrine of contraries and Blake's concept of Innocence and Experience, showing that although the contraries are

related to Innocence and Experience, they are not simply parallel to them, and that Blake's "The Tyger" is actually related both to the doctrine of contraries and to Innocence and Experience. Chapter iv is an extended analysis of The Marriage of Heaven and Hell, showing that Blake conceived of the doctrine of contraries in this work rather dialectically and that this doctrine was probably influenced by Blake's responses to Swedenborg and Boehme. Chapter v shows how the doctrine of contraries is related to the main structure of Blake's myth as this is to be seen in The First Book of Urizen and shows that Blake conceives of opposition as a necessary feature of any world whatever. It also shows the emergence of a distinction between those forces of an ideal "human" world, which Blake calls "contraries," and the oppositions of this world, or "negations." Chapter vi, based on Milton, shows the development of this distinction in Blake's later, more purely apocalyptic thought and shows how the Satan-Palamabron myth in this poem is a history of the confusion of the cosmic identities of the "human" contraries and how the apocalypse is to come about through the restoration of these identities, partly by means of Milton's distinguishing the contraries and negations of his own nature. Chapter vii consists of a short conclusion.

325 pages. $4.06. MicA54-1435

A BIOGRAPHICAL AND CRITICAL STUDY OF DORA SIGERSON SHORTER (1866-1918)

(Publication No. 7815)

Sister Marie Emily Smith, S. S. J., Ph. D.
University of Pennsylvania, 1954

Supervisor: J. Mark Longaker, A.B., Ph.D.

Among pioneers in the Irish Literary Revival were such famous personalities as William Butler Yeats, Douglas Hyde, Lady Gregory, John Millington Synge, Padraic Colum, James Stephens, and the poets of the 1916 rebellion: Pearse, MacDonagh, and Plunkett. Less well-known singers in the Irish choir (on the soprano side) included Katherine Tynan Hinkson, Dora Sigerson Shorter, Frances Wynne, Alice Furlong, "Moira O'Neill," Rose Kavanagh, Jane Barlow, Emily Lawless, Alice Milligan – the list seems inexhaustible. Chief among these as a narrative poet was Dora Sigerson Shorter, daughter of a distinguished physician and Gaelic translator, and wife of a widely-known English editor and bibliophile.

Mingled strains of old Norse sea-kings, of Huguenot emigrants, and of Celtic patriots and scholars, produced the enigmatic poet-soul of Dora Sigerson Shorter. She was born in Rathmines, Dublin, on August 16, 1866, the second of three children of George Sigerson and Hester Varian Sigerson. From her youth she was gifted in many ways – sketching, sculpturing, designing, and writing – and possessed vibrant health, unusual fondness for pets, and the ability to divert little children, whom she loved. Her personal beauty and rollicking sense of humor gained many friends, and her mother's delicate health accustomed her to the rôle of hostess quite early. Her father's Sunday evenings were a feature of Dublin social life for half a century.

Yet even in her first published poems, principally lyric, a dominant note of sadness appeared. Its source seems to have been a passionate patriotism, amounting to an obsession with the miseries of her country, long subject to England, and with the sufferings of compatriots who had endured penal servitude or death for political activities. Frequent visitors at the Sigerson home in Dora's childhood were Charles Kickham and John O'Leary; in her twenties, she was devoted to the cause of Parnell and worked for the Land League. Reverend Matthew Russell, S. J., encouraged her to publish Verses (1893). Katherine Tynan Hinkson contributed a review of this work, together with a photograph of the author, to The Sketch. The editor, Clement King Shorter, impressed with both, met Miss Sigerson at the Hinkson home; after correspondence and visits to Dublin, he married Dora Sigerson in 1896.

In London Dora was a popular hostess with Clement Shorter's friends, and made many of her own. She enjoyed decorating their home in St. John's Wood, and delighted even more in their country home at Great Missenden. The touch of her artistry was soon evident indoors and out, especially in the gardens at "Knockmoroon." If possible, she was more Irish in England than she had been at home. Fifteen volumes of poetry and five of prose came from her pen between 1898 and 1918; many of these were re-tellings of Irish legends, laments for defeated heroes, or nostalgic sighs for the homeland. She followed the fortunes of Irish politics with eager hope in the decade preceding World War I, and barely survived the disastrous failure of the Easter Week rebellion. What time remained to her she spent in vainly trying to save the convicted rebels, in raising funds to relieve their dependents, and in sculpturing a monument to the "Sixteen Dead Men." Exhausted from the strain, she collapsed, and, after an illness of some months, died on January 6, 1918. As she had wished, she was buried in Glasnevin, not far from the graves of O'Leary and Parnell.

Her story-telling gifts can be judged in such works as "The Ballad of the Wailing Ghost," "The Fairy Thorn Tree," "The Man Who Trod on Sleeping Grass," "The Woman Who Went to Hell," "The Story and Song of Black Roderick," "My Lady's Slipper," and "Madge Linsey," to name but a few. The haunting quality of her lyrics echoes in "Cean Duv Deelish," "Ireland," "A Bird from the West," "Sixteen Dead Men," "Sick I Am and Sorrowful," and "The Wild Geese," showing her long loneliness for the misty Irish hills, and her grief over Dark Rosaleen's woes. Her prose writings are less successful, as her true element was verse, especially on native themes.

Five years before her death, a reviewer wrote in The Nation: "Our sons will forget her, but our grandsons will rediscover her with surprise and delight." The radical changes in Ireland's politics since then make this prophecy seem unlikely to be fulfilled; but lovers of Ireland, as well as those who respond to deeply-felt emotion in verse, will find much to delight them in Dora Sigerson Shorter.

176 pages. $2.20. MicA54-1436

L'EMPLOI DE LA MYTHOLOGIE CLASSIQUE DANS LE THÉÂTRE FRANÇAIS DE 1870 À 1950

(Publication No. 8090)

Serge Sobolevitch, Ph. D.
Princeton University, 1953

My purpose is to examine the vogue of plays on mythological themes in France since 1870 (a chronological list shows that their number increases considerably after that date); to list and classify them; to discover the causes of this vogue and to come to some critical judgement on its literary and philosophical value and on its possible future development.

Eliminating several commonly used but misleading meanings of the word "myth" (myth as falsehood, Platonic myth, political myth), I establish the following categories: proto-history, legend (these two are not true myths), etiological myth (which is not proper dramatic subject matter) and heroic myth. With the help of previous definitions I then attempt to define heroic myth, analyzing it from four viewpoints: its form, its subject matter, the type of acceptance it demands from the spectator and the conception of time and space that it implies. This analysis is only concerned with what classical myth means to the contemporary theater-goer. I arrive at the following working definition:

> Heroic myth is the story of an action whose actors include both men or nearly human beings and gods or supernatural forces. This action occurs in a complementary universe which is real but different from the "real," every-day universe around us (with which it is in close correspondence). The complementary universe must be freely accepted as such by the spectator. The action of a heroic myth has no specific time or locale: it is eternally present in time and space.

Such a myth is meaningful only when considered as part of a tradition, of a mythology. I therefore outline the history of the formation of classical mythology and of its transmission to the present: it is a literary creation and must be judged by literary standards. The concept of legitimacy is now introduced as a criterion for judging the use made of mythology in the theater. A legitimate use of myth is one which does not attempt to convert it into history, sociology, philosophy, psychology, etc., but which allows it to retain its indispensable freedom and elasticity.

I then examine all available mythological plays written between 1870 and 1950 and classify them into six "traditions": the imitative, the burlesque, the Romantic (which primarily dramatizes history), the Symbolist (which reacts against the increasing mechanization and materialization of the world), the Surrealistic, and a modern re-vitalization of traditional forms. The last two start after World War I and reflect a major change in the underlying conceptions of the world which then occurs: a departure from traditional approaches (religious or scientistic) and a trend toward a new approach (intuitive and anti-intellectual).

I then proceed to a critical study: a search for the causes of this revival of dramatic mythology. Some of them have already emerged; certain other contributing factors, such as the re-use of Roman theaters, must also be considered. The main cause can be expressed in philosophical terms as the search for a tradition in a world which is rejecting its own; in dramatic terms it is the search for a true tragedy. In this the playwrights who turned to classical mythology came close to success, having written some excellent plays which are almost, but not quite, true tragedies. But in philosophical terms I come to the melancholy conclusion that these playwrights took the right step, but in the wrong direction: classical myth is not only outworn, it is fundamentally inadequate for our date; it is a dramatic impasse. Their finest plays were magnificent failures.

371 pages. $4.64. MicA54-1437

LANGUAGE AND LITERATURE, LINGUISTICS

A CRITICAL COMMENTARY ON THE VOCABULARY OF THE CANTERBURY PSALTER

(Publication No. 8221)

Charles Daniel Ludlum, Jr., Ph. D.
Stanford University, 1954

Among Old English Psalters Eadwine's Canterbury Psalter is unique in containing a great number of odd or unusual glosses, or instances in which the Old English word is not a literal translation of the Latin word to which it should correspond. It is the purpose of this study to provide some explanation of these peculiar glosses. Some of the methods I have used to interpret these hard words are as follows:

(1) The Old English word in question may be a translation of Biblical commentary upon the Latin word rather than a translation of the word itself. Thus at 9.12 the Latin phrase in sion is rendered on sion 1 on besceawodnesse; commentary interprets the Biblical name Sion as signifying 'speculation,' which in turn is the meaning of the unexpected besceawodnesse.

(2) Occasionally the Canterbury Psalter glossator(s) may have translated a variant Latin reading instead of the word which appears in the text of the Old English interlinear version. At 103.24 quam magnificata is glossed hu monige, 'how many,' which corresponds better to the variant quam multa.

(3) By far the greatest number of puzzling Old English words in this Psalter arise from a glossator's apparent misunderstanding of the Latin word being glossed. Thus at 112.3 occasum, referring to the setting of the sun and translated by the Cambridge Psalter as setlgange, 'a going down,' is taken by the Canterbury Psalter as occasum, 'occasion,' and translated fyrstmearc, 'space of time.' At 108.19 operitur is glossed as if it were aperitur, and zona is taken as sona. Inuenerunt is translated as if it were in

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

inuenerunt at 114.3, and odorabunt is confused with adorabunt at 113[2].6.

None of these ways of interpretation are applicable to hard words in the Canterbury Psalter alone. Other Old English Psalters contain examples of the translation of commentary, of the translation of variants and of mistranslations. But the Canterbury Psalter surpasses all others in the frequency with which outright mistranslations occur. This dissertation, in considering each unusual gloss resulting in such fashion, notes as a further characteristic of the Psalter the striking manner in which many Latin words have been misunderstood.

Pellicano: felle hundes at 101.7, although involving only the confusion of 'pellican' with pellis canis, 'dog's skin,' is nevertheless arresting. Amazing indeed is the verse (79.14): Exterminauit eam aper de silua et singularis ferus depastus est eam: abregde hie onforwyrd wuda 7 sinderlice swa whena wolberende hie. Here exterminauit, 'wasted,' is confused with exterruit and hence translated abregde, 'frightened'; in aper de, 'boar of,' the glossator has seen some form of perditio and has set down onforwyrd, 'destruction'; ferus, 'beast,' is taken as fere and hence glossed swa whena, 'almost'; finally, depastus est, 'devoured,' is confused with pestifer and hence is rendered wolberende, 'pestiferous.' In no other Old English Psalter did such a capricious glossator have a hand.

129 pages. $1.61. MicA54-1438

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

A CLASS OF MINIMAX TESTS FOR ONE-SIDED COMPOSITE HYPOTHESES

(Publication No. 8208)

Stephen Gatchell Allen, Jr., Ph.D.
Stanford University, 1954

Non-sequential minimax tests of composite hypotheses concerning a real-valued parameter are studied with reference to the following class of probability measures. If x denotes a point in a sample space X, then for any measurable set $A \subset X$ the probability measure of A is given by $\int_A g(T(x),\theta)d\mu(x)$, where θ is real, T is measurable, g is Borel measurable for every θ, and μ is a measure on X. In addition, it is assumed that the ratio $g(t,\theta_2)/g(t,\theta_1)$, provided it exists, is a monotone function of t for every pair θ_1, θ_2 such that $\theta_1 < \theta_2$.

The form of composite hypothesis to be tested is that $\theta \geqslant \theta_0$ as opposed to the alternative that $\theta < \theta_0$. Non-negative loss functions, continuous in θ, are assumed which, as usual, are restricted to zero whenever the hypothesis is correctly accepted or rejected.

Sufficient conditions are found so that the following class of test procedures will be minimax (fixed sample size) test procedures: if a single observation on a sufficient statistic for θ exceeds (is less than) some numerical criterion t_0, then the hypothesis is accepted (rejected); in the event that the observation equals t_0, the decision to reject or accept is randomized. As one restricts further the class of probability measures, e.g. the exponential sub-family where $g(t,\theta)$ is the product of exp $t\theta$ and a positive bounded function of θ, more specific conditions on the loss functions are obtained.

The method of finding minimax tests is illustrated in examples involving the normal, binomial, and hypergoemetric distributions. The loss functions in these examples are formulated with reference to the lot acceptance sampling inspection problem. For such loss functions the procedures are indicated for computing the acceptance number t_0, a suitable randomization scheme, an optimal size of sample, and the corresponding minimax risk.

37 pages. $1.00. MicA54-1439

AN APPLICATION OF STOCHASTIC PROCESSES TO CERTAIN PROBLEMS IN THE BROWNIAN MOTION OF CONTINUOUS MEDIA

(Publication No. 8110)

Glen Earl Baxter, Ph.D.
University of Minnesota, 1954

The purpose of this paper is to utilize the theory of stochastic processes in determining the stationary states (state of the system after a long period of time) of certain continuous, 1-dimensional physical systems undergoing Brownian motion. Mathematically, the author investigates the convergence of a particular sequence of stochastic processes $\{x_t(n), t \in T\}$ to a limiting stochastic process $\{x_t, t \in T\}$, i.e. the convergence as n becomes infinite of the finite dimensional distributions of the process $\{x_t(n), t \in T\}$ to the corresponding distributions of the process $\{x_t, t \in T\}$. Physically, he considers the Brownian motion of continuous, mechanical systems whose kinetic and potential energies have the form

$$T = \tfrac{1}{2}\int_a^b r(x)\left(\frac{\partial \xi}{\partial t}\right)^2 dx$$

$$V = \frac{\alpha}{2}\xi^2(a) + \tfrac{1}{2}\int_a^b \left\{p(x)\left(\frac{\partial \xi}{\partial x}\right)^2 + q(x)\,\xi^2\right\}dx + \frac{\beta}{2}\xi^2(b)$$

where $\alpha, \beta \geqslant 0$, p(x) is a positive continuously differentiable function on [a,b], q(x) is a continuous non-negative function on [a,b], and r(x) is a positive continuous function on [a,b]. One of the main results is that the stationary state of this system is described by a Gaussian stochastic process with covariance function equal to a multiple of the Green's function for this system.

In part I the author considers the mathematical problem associated with finding the stationary states. The method is to discretize the continuous system and to apply the method of Uhlenbeck and Wang to the discretized system. The stationary state of the discretized system is then described by a Gaussian stochastic process $\{x_t(n), t \in T\}$. The stochastic process $\{x_t, t \in T\}$ which describes the stationary state of the continuous system is found by passing to the limit, i.e. the limit of stochastic processes $\{x_t(n), t \in T\}$ is the process $\{x_t, t \in T\}$. In sections devoted to applications of the results, the connection between these results and Feynman's approach to quantum mechanics is mentioned briefly. Finally, examples are taken up. Also the author illustrates how the results can be extended to include more general physical systems than those described by the T and V given above.

78 pages. $1.00. MicA54-1440

A STUDY IN POLYNOMIAL APPROXIMATION IN THE COMPLEX DOMAIN

(Publication No. 8122)

Ernest Raymond Johnston, Ph.D.
University of Minnesota, 1954

In the following, C represents a closed rectifiable Jordon curve, and D = I(C) denotes its interior. For

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

C analytic Carleman proved that, (i) $p_n(z) \cong \sqrt{(n+1)/\pi}\ \phi^n(z)\ \phi'(z)$, all $z \in K$, as $n \to \infty$; $K = \overline{D}'$, $\{p_n(z)\}$ is the sequence of polynomials of precise degree n such that $\iint_D p_j \bar{p}_k\, dxdy = \delta_{jk}$, $z = x + iy$, and $w = \phi(z)$ maps K onto $|w| > 1$ so that $\phi(\infty) = \infty$ and $\phi'(\infty) = 1/a > 0$. (See, Archiv. for Math., Astron. ock Fysik, Vol. 17, No. 9, page 1, 1922.)

Under Carleman's hypotheses we show that (i) is also valid in a Frechet neighborhood of C in D.

As a major result, we prove that (i) holds also when C only satisfies certain conditions which are fulfilled if it has a continuous tangent such that the tangent angle as a function of arc length satisfies a Holder condition of order $\alpha > \frac{1}{2}$, but which are also much less restrictive than this.

Let $\mathcal{C}$ denote any bounded simply connected region such that $\overline{\mathcal{C}}' = \sigma$ and $\overline{\sigma}' = \mathcal{C}$. With $\mathcal{C}$ and σ replacing D and K, and for z in the complement of the closed convex hull of $\mathcal{C}$, we prove that $\left[q_n(z)\right]^{\frac{1}{n}} \cong \phi(z)$, where $\{q_n(z)\}$ is any polynomial sequence in a class which includes $\{p_n(z)\}$ and also other well known extremal sets. For a Jordan region $D = I(C)$, $\left[p_n(z)\right]^{\frac{1}{n}} = \phi(z)\left[1 + O(\frac{\log n}{n})\right]$ provided $\int_0^{2\pi} |h'(e^{i\theta})|^q\, d\theta$ exists for some $q > 1$, where $z = h(w)$ maps $|w| < 1$ onto D.

The Faber polynomials $\{f_n(z)\}$, which corresponds to the right member of (i) are studied in detail. For $D = I(C)$, C mildly restricted, the function class $\mathcal{L}^2_D$ is the same as the class

$$\left\{ f(z) = \sum_{k=0}^{\infty} b_k f_k(z),\ \sum_{k=0}^{\infty} |b_k|^2 < \infty \right\},$$

and there exists $\lambda(C) > 0$ such that

$$\lambda R_n \leqq \left\| f(z) - \sum_{k=0}^{n} b_k f_k(z) \right\|^2_D \leqq R_n,\ R_n = \sum_{k=n+1}^{\infty} |b_k|^2.$$

The "Faber coefficients" b_k are defined in terms of certain Fourier coefficients. If $f(z) \in H(C, pq)$, with C of Smirnoff type and $\phi(z)$ satisfies an integrability condition depending on p and q, then

$$\left\| f(z) - \sum_{k=0}^{n} b_k f_k(z) \right\|^2_D = \begin{cases} o(\frac{1}{n}) \text{ for } p \geqq 2 \\ O\left(\left[\frac{1}{n}\right]^{\frac{2(p-1)}{p}}\right) \text{ for } 1 < p < 2. \end{cases}$$

With R replacing K, where R is any simply connected region such that $\infty \in R$, $R' = \overline{E}$ is bounded, and $\overline{R}' = S \neq 0$, we prove that

$$\Gamma_R(z,\zeta) = \sum_{k=0}^{\infty} f_k(z)\, \overline{f_k(\zeta)} = 1/\pi^2 \iint_R (\sigma - z)^{-2} \overline{(\sigma - \zeta)}^{-2}\, d\xi\, d\eta,\ \sigma = \xi + i\eta, \text{ for all } z, \zeta \in S.$$

Two function theoretical and two algebraic theorems obtained and used in the paper are of independent interest. For any region $D = I(C)$, we show that the class $\mathcal{L}^2_D$ contains $H(C, p)$ for $p \geqq 1$. In fact, $\|f\|_D \leqq 1/\sqrt{2} \int_C |f|\, |dz|$. If $\int_0^{2\pi} |h'(e^{i\theta})|^q d\theta$ exists for some $q > 1$, the class consisting of all functions which are integrals of the functions of $\mathcal{L}^2_D$ is a subclass of $H(C, p)$ for all $p > 0$. If $F(z) = \int_\xi^z f(t)dt$, $\xi \in D$, then $\left[\int_C |F|^p\, |dz|\right]^{\frac{1}{p}} \leqq K(C, \xi, p)\, \|f\|_D$. The two algebraic theorems deal with double infinite series with dominant main diagonal, but relax the usual hypotheses, for theorems of this type, on the smallness of the off-diagonal terms somewhat, and add a linear independence condition. Let (V,w) represent a positive definite Hermitian scalar product, and $\|w\| = \sqrt{(w,w)}$. Suppose $\{V_j\}$ is a sequence of functions such that $\sum_{k=0}^{j-1} |V_k|^2/|V_j|^2$ is bounded on some set $E\ (j \geqq J)$, satisfies a certain "strong" linear independence condition in terms of $\|w\|$, and $(V_j, V_k) = \delta_{jk} - e_{jk}$, $\sum_{j,k=0}^{\infty} |e_{jk}|^2 < \infty$. Then these two algebraic theorems imply that $V_j = w_j\,[1 + o(1)]$ on E, where $\{w_j\}$ is the orthonormal sequence derived from $\{V_j\}$ by the Gram-Schmidt process.

157 pages. $1.96. MicA54-1441

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

MINEROLOGY

AN EXPERIMENTAL STUDY OF INTERCONVERSIONS AMONG IRON CARBONATES, OXIDES, AND SULFIDES

(Publication No. 8125)

Henry Lepp, Ph.D.
University of Minnesota, 1954

A review of the geochemistry of iron shows that very appreciable quantities of iron oxides, carbonates, and sulfides are concentrated in the exogenic or surface cycle of matter. It is proposed that such sedimentary concentrations may be greatly altered on exposure to endogene conditions; sufficiently altered to erase their sedimentary characteristics, and to impart to them those criteria which geologists have come to interpret as meaning mass introduction. Such a possibility should certainly be seriously examined in any hypothesis dealing with the origin of concentrations of iron minerals.

Since steam (or water), H_2S and CO_2 are among the more common known constituents of magmatic gases, experiments were made to determine the stabilities of several iron minerals in mixtures of these gases at temperatures from 100 to 550° C. The experiments show that iron minerals may be greatly altered by exposure to one or more of the gases at these temperatures. More specifically the following conclusions are suggested by the experimental work:

(1) Siderite, pyrite and pyrrhotite are oxidized in steam alone at temperatures beginning around 150 to 200° C. In a closed system the product of oxidation of either of these minerals in steam is magnetite. In an open system where the hydrogen generated is continually removed, hematite forms.

(2) At temperatures above 350° C the action of steam on pyrite first produces pyrrhotite. Continued exposure in an open system results in the formation of magnetite.

(3) The dissociation pressure of pyrite was measured at temperatures down to 375° C. In a stream of inert gas pyrite dissociates slowly into pyrrhotite and sulfur at temperatures as low as 250° C.

(4) Siderite, hematite, goethite or lepidocrocite are changed to iron sulfides when exposed to H_2S or to mixtures of H_2S with steam and CO_2 at temperatures from 120 to 350° C. The final product (pyrite or pyrrhotite) depends on the partial pressure of sulfur in the gas stream. The above reactions are also known to occur at lower temperatures in water solutions. In such cases the product formed is probably dependent on the sulfide ion concentration.

(5) The rate of oxidation of natural and synthetic siderite in air is related to the amount of diadochic substitution for iron in the siderite structure. Hematite is the principal product of such oxidation, although some goethite is commonly produced. The experiments show that a siderite with less than 41 per cent ferrous iron is fairly stable under normal atmospheric conditions.

(6) Differential thermal analyses of magnetite specimens show that magnetite goes through two stages of oxidation when heated in air. The first stage occurs at temperatures between 200 and 565° C, and it is related to the fineness of the specimen. The second stage begins at around 565° C and it is often not complete even at 1050° C. It is suggested that the first stage involves a change from magnetite to gamma-Fe_2O_3 on the grain surfaces.

(7) The action of H_2S on ferrous salt solutions at room temperatures under slightly alkaline conditions (pH 8-9) produces a black, magnetic, iron sulfide which has a different X-ray powder pattern from either pyrite, marcasite or pyrrhotite. This sulfide is probably a synthetic melnikovite. Synthetic melnikovite changes to pyrite when subjected to slightly elevated temperatures (75 to 250° C). It reacts with carbonated water to form $Fe(HCO_3)_2$ and H_2S at room temperature.

(8) Precision measurements show no appreciable variation in the cell dimension of pyrite with temperature of formation. 108 pages. $1.35. MicA54-1442

MUSIC

AN EXPERIMENTAL EVALUATION OF THE TRANSFER EFFECTS OF RHYTHM TRAINING IN SPACED NOTATION ON SUBSEQUENT READING OF COMMERCIALLY PRINTED MUSIC

(Publication No. 8135)

Dana Norman Peitersen, Ph.D.
University of Minnesota, 1954

Research on the problem of rhythm instruction indicates that correct impressions from the printed score are positively influenced where the linear spacings between symbols are proportionate to the relative time values of the symbols. The present study sought to determine whether such attention to the materials of instruction influences accuracy in the later reading of commercially printed music not so proportioned.

Three groups of pupils (N = 96) were selected by random methods from each of two junior high school bands. Two of the groups within each band received twenty-minute, twice-weekly periods of specialized instruction during the school year for a total of fourteen and one-third hours. The third group served as

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

a control, receiving normal band instruction during the same periods. Within each band the two groups receiving specialized instruction rehearsed together using music which differed with respect to the spacing of the symbols. Those in the spaced note group used music which had been re-written so that the linear spacing was in direct ratio to the durational values of the symbols. The non-spaced group was provided with the regular, published editions of the same music. This procedure provided for valid comparison between (1) groups receiving specialized instruction and those receiving only normal band instruction; and (2) groups using spaced music and those using commercially printed materials.

Evaluation was made in terms of three sets of scores based on two performance tests constructed from commercially printed music. The first of these tests consisted of thirty-one one-measure rhythm patterns of unspecified pitch. Judgments of the accuracy of performance, as evaluated from tape recordings of pupil readings of this music provided quasi-subjective scores, while analysis of a graphic record of these same performances produced scores of an objective nature. Judgmental evaluations of recorded performances of the second test, consisting of complete musical phrases, provided the third set. Thus, scores representing three levels of objectivity were obtained.

The two-way classification resulting from the experimental design was examined by the analysis of variance and covariance techniques after first investigating the contributions of I.Q., grade point average, months of instruction, and initial test scores to each of the three final measures of performance. Although the results of an exploratory study, conducted for the purpose of determining the adequacy of the time-distance ratio used in the preparation of the instructional materials, showed significant advantages (1 per cent level) of spaced notation over non-spaced notation with respect to immediate perception of rhythm patterns, results of the main experiment failed to indicate that any unique advantage in the reading of non-spaced music can be attributed to training in spaced music. However, those groups receiving specialized instruction showed significant superiority over those receiving only normal band instruction during the same class periods.

These results indicate that specialized rhythm instruction can be an effective and efficient means of increasing the quality and accuracy of rhythm in later performance, but that further increases should not be expected to result from the proportionate spacing of the music symbols within the instructional materials. The advantages of spaced notation appears to be confined to the immediate reading of music so prepared. 312 pages. $3.90. MicA54-1443

AN EXPERIMENTAL PROGRAM FOR IMPROVING THE SIGHT-READING ABILITY OF CORNET AND CLARINET PLAYERS

(Publication No. 7571)

Ralph Curtis Rea, Ph.D.
State University of Iowa, 1954

Chairman: Himie Voxman

In this dissertation the more important experimental studies in the field of music-reading were reviewed and the following conclusions drawn:

1. Experimenters have obtained considerable evidence that good readers of music read patterns of notes while poor readers read individual notes. No doubt, one of the reasons for poor reading in music is the slow and inaccurate perception of music symbols.

2. While the transfer of visual image to the performance idiom may give many students trouble, the items which cause the most reading difficulty and compel the eyes to pause for longer fixations are: (a) extreme high or low notes (range), (b) an extended passage of fast notes (speed), (c) complicated rhythmic passages (time), (d) highly chormatic passages (accidentals), (e) wide skips between notes (intervals), and (f) many sharps or flats in the key signature (keys).

3. Training in the recognition of musical materials may result in a broadening of the visual span; however, such training in itself does not usually result in improved sight-reading ability. In this respect, there seems to be a lack of transfer of training.

4. The eye-movement must be far enough ahead of performance to identify, understand, and deal with the elements of the tonal-rhythmic pattern and still maintain some lead at all times. Furthermore, since note values and note locations must be retained in memory, the span of recognition is influenced by memory. One must actually read a group of symbols while playing the previous group.

5. The need for objective and reliable measures of performance has been felt, and much of the data derived from experimental work in the field of music reading may be unreliable because of the use of non-valid tests of reading ability. No group test of the paper-and-pencil variety has as yet been constructed that will correlate highly with an individual performance test.

The Problem

In view of the need for improved methods of instruction in the area of music reading, this study represents an attempt to originate such a training program.

Music reading films. A series of twelve 16mm motion-picture films was produced as a training program to improve the sight-reading ability of cornet and clarinet players. The music selected for filming was arranged progressively as to the degree of rhythmical, technical, and reading difficulty. The method of photography prevents the player from any reading by regression of eye-movements; it forces him to read ahead of actual performance at all

times; and it should increase his ability to retain a memory of exposed material until time to play it. Furthermore, in playing the music as it is projected on the screen, the student is given practice in sight-reading many complicated rhythmic figures, highly chromatic passages, extended runs of fast notes, wide skips in note intervals, and a variety of keys. In brief, the filming process forces a method of desirable reading on those pupils whose reading habits have become more or less undesirably fixed, and the kind and amount of music to be read provides the conditions of practice that are necessary to learning.

Experimental Study

The above mentioned music reading films were used in an experimental training program in an effort to: (1) evaluate them as a training device, (2) seek the most effective manner of using this material, and (3) determine the importance of the training of eye-movements in improvement of sight-reading skill.

The findings. Satisfactory evidence was obtained as to the effectiveness of the material selected for use in filming. On the average, students taking part in the experiment improved as much in a period of six weeks as they had during the previous twelve months. Judging from their ability to maintain performance, all the students who read the music from the films improved in their capacity to read ahead while playing, however, the training of eye-movements in this respect did not prove to be statistically significant. The experimenter felt that the length of the training program (six weeks), and the number of sessions per week (two) was about right for high school students, but that some supplementary materials should be used in conjunction with the films. Even higher gains in sight-reading ability might be attained with the use of exercises to improve the student's technical facility in the more difficult keys and with the use of rhythm studies to develop the skill of playing complicated rhythmic patterns.

Application of Findings

1. The Watkins sight-reading test for cornet which in this study was transposed for use with other brass and woodwind instruments appears to be the most reliable measure of instrumental performance available to the research worker today.

2. The method of filming music as developed in this study provides a basis for the production of similar courses of study. Certain difficult problems of production were solved which, if utilized by other experimenters or motion-picture laboratories, should make comparatively easy the construction of sight-reading films at different levels of comprehension and for many other combinations of instruments or voices.

3. Designed for use with high school music students, the Music Reading Films developed in this study are being produced by the University and are available for purchase or rental from the Bureau of Audio-visual Instruction, Extension Division, State University of Iowa.

4. This study would seem to substantiate the opinion of many musicians and music educators who maintain that skill in sight-reading can best be acquired by reading a large quantity of music varied in all the problems encountered by the reader in actual performance. 140 pages. $1.75. MicA54-1444

PHARMACOLOGY

A PHARMACOLOGICAL STUDY OF SERENOA REPENS (BARTRAM) SMALL BERRIES

(Publication No. 8157)

Seldon Dick Feurt, Ph.D.
University of Florida, 1953

Fluidextract of Serenoa repens (Bartram) Small berries, N. F. VIII, showed no adrenal cortical nor estrogenic activities, however, it prolonged the stage of estrus in rats. Evidence of a pressor amine in this extract was demonstrated by pharmacological actions on blood pressure, bronchioles and peripheral blood vessels, and chemically by the formation of alkylated and diazo addition compounds. The use of Serenoa as a diuretic was vindicated.

This extract possessed no lactogenic activity when tested on rats or guinea pigs, however, it elicited crop-sac proliferation in pigeons. Prolactin is not specific in eliciting crop-sac proliferation.

112 pages. $1.40. MicA54-1445

EXPERIMENTAL PRODUCTION OF HYPERTENSION IN THE RAT AND A PRACTICAL APPARATUS FOR RECORDING THE RAT'S BLOOD PRESSURE

(Publication No. 8158)

Henry Douglas Johnson, Ph.D.
University of Florida, 1953

Methods for inducing experimental hypertension in rats were studied and their advantages and disadvantages discussed. Particular emphasis was placed upon audiogenic hypertension which would bear a closer relationship to human essential hypertension than do other experimental hypertensions. This method was not recommended because of its unreliability and the great length of time required to produce high blood pressure. Hypertension induced by the implantation of desoxycorticosterone acetate was recommended as the simplest and most dependable of experimental hypertensions.

Hypertension resulting from sodium chloride administration was unsatisfactory because of the poor health of animals kept on the required regimen. Hypertension due to renal ischemia required more difficult technique and was unpredictable in onset although otherwise it was satisfactory.

A practical apparatus for measuring the systolic blood pressure was constructed and is described in detail. 57 pages. $1.00. MicA54-1446

THE INFLUENCE OF VARIOUS AGENTS UPON THE DEPTH AND DURATION OF MORPHINE ANALGESIA IN RATS

(Publication No. 8050)

Bernard Levy, Ph.D.
Purdue University, 1954

Major Professor: L. D. Edwards

Twenty compounds were tested for their ability to potentiate or prolong the analgesic activity of morphine sulfate in rats. A modification of the heat stimulus method as originally developed by Wolff-Hardy-Goodell was used to measure analgesic activity.

Urethan produced potentiation and prolongation of morphine analgesia to a slight extent. Calcium gluconate produced some potentiation of morphine analgesia but toxic symptoms were encountered. Atropine sulfate potentiated and prolonged the analgesia of morphine. Polyvinylpyrrolidone (PVP) and dextran markedly potentiated and prolonged morphine analgesia. PVP proved to be the most effective morphine potentiator in this study. BAL, ascorbic acid, and calcium gluconate did not significantly potentiate morphine analgesia in therapeutic doses.

Nine diphenyl derivatives were tested for their ability to potentiate morphine analgesia. Trasentine was very effective. Sodium diphenate was ineffective in non-toxic doses. Comer's compound, 1-diphenyl-4-dimethyl-aminopropyl pentanoate, markedly potentiated morphine analgesia. Sinotte's compound, bis-(3-phenyl-propyl) amine HCl, was without effect in safe doses. Benadryl and Histadyl effectively potentiated morphine analgesia. Chlor-Trimeton was one of the most effective diphenyl derivatives employed. Pavatrine did not significantly effect morphine analgesia. Pretreatment of rats with estrone over a two week period did not sensitize the animals to morphine analgesia. Pretreatment of rats with thyroid for five days did not sensitize them to pain or to the analgesic activity of morphine sulfate.

Administration of morphine sulfate in solutions of PVP following pretreatment of the rats with Trasentine, Histadyl or Chlor-Trimeton produced greater potentiation and prolongation effects than any of these compounds when given alone.

96 pages. $1.20. MicA54-1447

THE DEVELOPMENT OF MEDICINAL MEMBRANES CONTAINING ION EXCHANGE ADSORBATES

(Publication No. 8054)

Wilson Nashed, Ph.D
Purdue University, 1954

Major Professor: Glen J. Sperandio

It is postulated that an ion exchange adsorbate of a cationic or anionic antibacterial agent on coming on contact with serum would exchange the antibacterial agent for the similarly charged ions present in the serum until the establishment of equilibrium. Two chief advantages of a slow continuous release of antibacterial agents in this type of therapy are prolonged contact of the medication at the site of application and less disturbance of the wound caused by frequent changing of dressings.

The following represents the work carried out to develop and study such a preparation.

1. Plastic membranes composed of vinyl polymers, plasticizers and non-ionic surfactants have been developed. They are capable of holding ion exchange resin particles and allow an exchange reaction to take place on contact with serum.

2. A technique is presented for investigating the factors affecting exchange rate between resin-membranes and serum electrolytes.

3. The effect of particle size of an ion exchange resin on the rate of release of H^+ in serum has been investigated, and it was confirmed that with a decrease in particle size of the resin an increased exchange rate is obtained.

4. The effect of variation in serum volume has been investigated and it was found that with increased serum volume there was a decrease in the rate of exchange and in the concentration of the released H^+ at equilibrium.

5. The effect of the degree of cross linkage of a resin on the exchange rate has been investigated. It was found that with decreased cross linkage, a corresponding increase in rate of exchange was obtained in the case of 1%, 2%, 4% and 16% cross linkage. However, with 8% the rate was too fast and with 12% too slow. This could be due to variation in the commercial product used.

6. The effect of the variation of $[H^+]$ within the resin on its rate of release in serum was studied. It was concluded that the variation of H^+ concentration within the resin does not affect the exchange rate, provided the ratio of available H^+ to serum volume is maintained constant.

7. The capacities of various anionic resins for parachlorophenol were determined and a resin adsorbate was developed. A gradual release of part of the adsorbed parachlorophenol was observed on contact with human plasma. Membranes containing the adsorbate or the free parachlorophenol were tested for the release of parachlorophenol in water. It is concluded that the release of parachlorophenol in serum is mainly due to ion exchange. It was seen that the exchange effect tends to overcome the tendency of the membrane to retain the parachlorophenol.

8. A resin adsorbate of streptomycin has been developed and tested for the release of streptomycin in human plasma. It was concluded that the release of streptomycin is mainly due to ion exchange with serum electrolytes and that the exchange effect tends to overcome the tendency of the membrane to retain streptomycin. 103 pages. $1.29. MicA54-1448

A STUDY OF THE HYPOTENSIVE ACTION OF POLYPODIUM POLYPODIOIDES

(Publication No. 8057)

Jesus Santos-Martinez, Ph.D.
Purdue University, 1954

Major Professor: L. D. Edwards

Crude and purified extracts prepared from Polypodium polypodioides (L.) Hitchcock displayed a hypotensive action in the rat, rabbit, chicken, cat and dog when administered intravenously. This effect was not abolished by atropinization in the cat or vagotomy in the dog or pithing in the rat. No vasodepressor action was displayed by the extracts when given orally to rats. Purified extracts, when studied by means of arterial strips and perfusion experiments, caused contraction of blood vessels. Purified extracts produced a negative inotropic effect upon the perfused rat and guinea pig hearts; and a slight positive inotropic effect upon the rabbit's heart. They produced a strong and pronounced negative inotropic effect on the perfused frog heart which was followed by an increased tonotropism and then by a negative inotropic and chronotropic effect. Purified extracts displayed a spasmolytic effect upon the rat uterus in situ. Irritation studies indicate that the purified extracts are highly irritant. Acute intravenous toxicities in the mouse and rat were determined. Prolonged intraperitoneal administration of the extract to rats caused pathological conditions in the spleen and dorsal aorta.

Phytochemical studies indicate that the active principle responsible for the vasodepressor action is an acidic tannin. No tests were obtained to indicate the presence of a saponin. A β-glycoside was determined to be present in the plant.

134 pages. $1.68. MicA54-1449

PHILOSOPHY

BERKELEY'S CRITICISM OF ABSTRACT IDEAS

(Publication No. 8126)

John S. Linnell, Ph.D.
University of Minnesota, 1954

An examination of the evidence shows that Berkeley's criticism of abstract ideas is basically directed against Locke. The latter conceived of abstract ideas as framed by the mind by an activity for which the raw material is ideas which are not abstract, — ideas of sense and ideas of reflection. Thus, the idea of White is the result of an operation performed by the mind on the perceptual ideas involved in seeing a white object (e.g. milk). This operation is separation, omission of context. Thus, the abstract idea of White is a part of the perceptual nexus of ideas which has been isolated by "leaving out" and "retaining". Locke also attempted to interpret the relation between generic and specific ideas in terms of these same operations. In effect, then, Locke is treating perceptions as though they were complex (indeed, infinitely complex) thoughts. This absence of a sharp distinction between conceiving and perceiving is characteristic not only of Locke, but of most of his contemporaries, and can be traced to medieval thought. It provides the context for a correct understanding of Berkeley's position. Thus, it is decidedly misleading to say that Berkeley took a sensationalistic approach to thought. It would be far truer to say that he assimilates sensation to thought.

Berkeley's rejection of abstract ideas is one of the major themes of his philosophy. It was developed in his early notebooks, and, as is shown by an examination of the evidence, runs through all his writings to, and including, his last work, the Siris. It plays an essential role in his argument for immaterialism. It is also a weapon frequently brandished in Berkeley's discussions of science, mathematics, and theology.

Against the above background, it can be seen that the central theme of Berkeley's denial of abstract ideas is the denial that there can be an idea which is solely of Color, of Triangle, of any determinable. He is not denying that we can think of determinables; rather he is denying that there can be ideas whose content is determinable only. Thoughts of determinables are not separate ideas; they are concerned with distinguishable aspects of the contents of ideas of determinate forms of the determinables. To think of Color is not to have an idea solely of Color; it is to distinguish a feature or aspect of my idea of some determinate color, say crimson. From this point of view, Berkeley belongs in the Conceptualist tradition, though he gives it a novel twist.

Yet it must be admitted that Berkeley, like Locke, tended to confuse between an idea of ϕ and a ϕ idea; that is, between an item which is about ϕ, and one which exemplifies ϕ. Thus, his criterion for the minimal scope of an idea of ϕ is What must be exemplified in order for ϕ to be exemplified. If ϕ cannot be exemplified without ψ, then there can be no idea which is of ϕ without being of ψ. He often talks as if the idea of a crimson isosceles triangle were a crimson isosceles triangle.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

This interpretation of Berkeley's rejection of abstract ideas dissolves the supposed incompatibility between the Siris and the Principles. Not even in the Principles would Berkeley have denied God thoughts of all objects. These thoughts would differ from our ideas in that God has them qua active, rather than qua passive. Berkeley does not explore, as did the Continental Rationalists, the implications of this contrast. In both the Principles and the Siris Berkeley would deny that either God or man could have thoughts of which the content is determinable only. 277 pages. $3.46. MicA54-1450

PHYSICS

PHYSICS, GENERAL

SOME CONTRIBUTIONS TO ATOMIC BEAM SPECTROSCOPY

(Publication No. 8037)

George Victor Deverall, Ph.D.
Purdue University, 1954

Major Professor: K. W. Meissner

In order to resolve very close components of a spectral line it is necessary to use a light source which produces narrow lines. For the investigations reported in this thesis an Atomic Beam Light Source was used. The width of the lines produced by this beam could be completely accounted for in terms of the Natural and Doppler Width. The effective temperature for Doppler width was less than 5^0 Kelvin.

With the atomic beam light source and a Perot-Fabry interferometer crossed with a stigmatic prism spectrograph, the hyperfine structure of indium and the isotope shift of germanium were investigated.

The results of the indium investigation (see Deverall, Meissner and Zissis, Phys. Rev. 91, 297, (1953)) confirmed the values obtained by the RF methods by Mann and Kusch, and Kusch and Foley for the $5^2P_{3/2}$ and $5^2P_{1/2}$ level. The splitting for the the $6^2S_{1/2}$ level was found to be 0.2814 ± 0.0005 cm^{-1}.

The isotopic shift for germanium was not directly measurable due to its very small value. A densitometer trace of the fringe pattern, however, did show that the fringes of the 2691A and 2592A were definitely asymmetric. This asymmetry was accounted for by assuming that the observed line was a result of the superposition of radiation emitted by the four even-even isotopes. As a result of this analysis it can be asserted that the isotopic shift for the two lines studied is less than 0.01 cm^{-1} and the best estimate of its value is 0.005 ± 0.003 cm^{-1}.

In both the indium and the germanium investigation, the wavelengths of the lines excited in the beam were determined.

The design and construction of a new atomic beam light source is discussed. This beam uses microwaves to oscillate an electron cloud in the region between two opposing electron guns. It is expected that by this method of excitation a beam of higher intensity can be produced.

In connection with the application of Perot-Fabry interferometry to the resolution of small splittings, both an analytical and a graphical method are discussed for the selection of optimal spacers, (see G. V. Deverall, K. W. Meissner and G. J. Zissis, J. Opt. Soc. Am. 43, 673, 1953)).

138 pages. $1.73. MicA54-1451

INTERACTION OF IMPURITIES AND MOBILE CARRIERS IN SEMICONDUCTORS

(Publication No. 8049)

Guy Walter Lehman, Ph.D.
Purdue University, 1954

Major Professor: Herbert M. James

The effect of the interaction between mobile carriers and impurities in semiconductors on the activation energy of impurity atoms has been investigated. Electrons trapped on impurity ions move in a resultant field due primarily to the ion (treated as a point charge) and the surrounding distribution of untrapped carriers; the untrapped carriers move in a field due to neutral impurity atoms, impurity ions, and other carriers. The orbitals for trapped and untrapped carriers have been determined by approximate solution of appropriate Hartree equations. Because of the temperature dependence of the distribution over states of mobile carriers, the orbitals of the theory depend on the temperature as a parameter. For given temperature and impurity concentration $\bar{N}$, the electron concentration $\bar{n}_e$ depends on the activation energy, and the activation energy depends on the electron concentration; these two quantities are thus determined by a consistency relation. The theory is limited to non-degenerate semiconductors, and fluctuations due to the random distribution of impurities are neglected.

The theory yields results differing significantly from those of the simpler theory of Pearson and Bardeen. When the impurity concentration is high, the carrier concentration tends to fall more rapidly with decreasing temperature, and the activation energy, deduced in the usual way from the relation of $\bar{n}_e$ to T, tends to zero in a more nearly linear way with increasing impurity concentration.

95 pages. $1.19. MicA54-1452

THE EVALUATION OF THE ERRORS INVOLVED IN THE MEASUREMENT OF SURFACE TEMPERATURES WITH THERMOCOUPLES AFFIXED TO THE SURFACE BY ADHESIVE TAPE

(Publication No. 8142)

George Keith Stillwell, Ph.D.
University of Minnesota, 1954

A method of measuring the temperature of test surfaces by means of a radiometer is given. This involves the determination of the thermal emittance of the surface, the method for which is also given and evaluated. The means of construction and evaluation of the performance of the thermopiles employed is presented. The temperature of the surface around the periphery of the radiometric field was measured by thermocouples of copper and constantan fixed to the surface by adhesive tape. The difference between the thermocouple temperatures and the radiometric temperature obtained at the same time represents the error of the thermocouple method.

The temperature difference between the surface and its environment is defined as the "cooling gradient". This has a positive cooling action on the surface when the surface is at a higher temperature than its surroundings. The minimum error of the thermocouples was found to be plus or minus 0.1° C when the cooling gradient was less than 1° C. As the cooling gradient increases from 0 to about 6° C, the thermocouples report temperatures progressively lower with respect to the radiometric temperature. On a copper surface covered by a layer of flat black paint, thermocouples covered by one layer of adhesive tape read about 0.4° C lower than the radiometric temperature when the cooling gradient is 6° C. This error is approximately doubled when the surface is that of a layer of rubber 0.035 cm. thick backed by a copper plate, and reaches a value of about 1° C when the surface is that of a piece of rubber 0.2 cm. thick. As the cooling gradient increases beyond 8° C, there is a tendency for the thermocouple error to return toward zero.

As the cooling gradient increases from zero, there is increasing heat loss from the thermocouple junction area along the lead wires, causing the thermocouple to report a temperature lower than the true surface temperature. At the same time the inhibition of radiant exchange of heat between the surface and its environment by the thermocouple and its adhesive tape tends to cause the temperature of the surface in the thermocouple area to rise. The radiation error increases by greater increments than does the conduction error. The actual error of the thermocouple reading is the algebraic sum of the conduction error and the radiation error. The unequal development of these two portions of the total error explains the point of inflection in the thermocouple error curve. It is likely that the thermocouples would read too high instead of too low when the cooling gradient exceeds 10° C.

The differences of the thermocouple error on different surfaces are explained by the different thermal conductivities of the underlying substances. Varying the sizes of the copper and constantan wires of the thermocouples had relatively minor effects on the thermocouple errors which can be rationalized on the basis of the conductivities of the lead wires.

Covering the thermocouple with more than one layer of adhesive tape decreased the error to about half the magnitude of that with one layer of tape with a cooling gradient of less than 8° C. Leaving the tip exposed decreased the error also, except with a thermocouple made of copper 0.04 cm. in diameter and constantan 0.018 cm. in diameter. The variations with different numbers of layers of adhesive tape are not readily explicable.

From the literature, one would expect the accuracy of thermocouples as skin thermometers to be within 0.2° C at best. These experiments would lead one to expect that in some circumstances the accuracy would be substantially less.

112 pages. $1.40. MicA54-1453

PRECISION INTERFEROMETRIC MEASUREMENTS USING AN ATOMIC BEAM LIGHT SOURCE

(Publication No. 8061)

George John Zissis, Ph.D.
Purdue University, 1954

Major Professor: K. W. Meissner

Precision interferometric determinations of the wavelengths of the resonance lines of indium were made during an investigation of the hyperfine structures of these lines (Phys. Rev. 91, 297 (1953)). The values as measured with respect to the krypton line 4273.9700 A are:

4511.3287 A	4511.2714 A	4101.8054 A
4511.3211 A	4511.2637 A	4101.7581 A
4511.3166 A		4101.7413 A
4511.2833 A		4101.6940 A

Several of the strongest lines of the germanium arc spectrum were also measured with highest accuracy in conjunction with a study of isotopic shift in germanium. The wavelength values, determined with respect to the green line of a Meggers Hg^{198} discharge lamp, are:

3269.48886 A	3039.06712 A
2754.58781 A	2709.62372 A
2691.34105 A	2651.56833 A
2651.17201 A	2592.53402 A

The isotopic line shift is found to be less than 0.01 cm^{-1} and is estimated to be 0.005 ± 0.003 cm^{-1} in the 2592 A line.

The above investigations were made by means of an emission atomic beam source and a Perot-Fabry interferometer crossed with a stigmatic prism spectrograph.

A brief discussion of high precision Perot-Fabry interferometry and some of the attendant problems is presented. A treatment of graphical and analytical

methods for selection of proper etalon thickness is given in "Selection of Optimal Spacers in Perot-Fabry Interferometry", J. Opt. Soc. Am. 43, 673 (1953). 135 pages. $1.69. MicA54-1454

PHYSICS, ELECTRONICS AND ELECTRICITY

HIGH-FREQUENCY AIRBORNE DIRECTION-FINDING

(Publication No. 8212)

Philip Staats Carter, Jr., Ph.D.
Stanford University, 1954

Previous to the development reported here, there has been no method for radio direction-finding from aircraft at high frequencies (2-30 Mc). In this frequency range electromagnetic scattering from the airframe distorts the patterns of a conventional loop direction-finding antenna so that the direction of the source field is nearly completely obscured.

It is shown that, by making proper use of the symmetries of the airframe, a direction-finder may be designed which eliminates most of the effects of radiation scattered from the airframe. An experimental investigation of the properties of this antenna shows that it represents a considerable improvement over conventional systems.

The first part of the investigation is devoted to establishing the deficiencies of conventional direction-finders in this frequency range. The magnitude and phase of the field scattered from the airframe are shown as a function of frequency of operation. It is shown that this scattered field precludes accurate direction finding in the frequency range 7-24 Mc.

The enhancement of direction finder accuracy by the use of a "balanced wing-loop direction finder" is shown in the results of an experimental investigation. This antenna consists of two equal loop antennas mounted on the upper and lower wing surfaces and fed so that the loop-to-wing coupling coefficient is nearly zero. The experimental investigation shows that the directional accuracy of this antenna is within $\pm 5^0$ at frequencies below 14 Mc, and within $\pm 15^0$ at frequencies 14-24 Mc.

93 pages. $1.16. MicA54-1455

PHYSICS, NUCLEAR

HIGH ENERGY ELECTRON SCATTERING FROM ATOMIC NUCLEI

(Publication No. 7492)

Harry Robert Fechter, Ph.D.
Stanford University, 1954

High energy electron scattering experiments have been carried out for the elements Au, Pb, Ta, Be, and the hydrocarbons (essentially) CH_2 and CD_2. Using energies of 25, 125 and 150 Mev, relative cross sections were obtained over an angular range from 35 to 140 degrees. For gold at 125 Mev the reduced electron wavelength $\lambda\!\!\!^{-}$ is one-fifth the nuclear radius. By fitting theoretical curves based on Born approximation and exact calculations to the experimental data, it is tentatively concluded that the nuclei of heavy atoms have a variable charge distribution, dense at the core and dropping off in such a manner that rapid changes in charge density are not encountered.[1,2] The present state of theory and experiment does not allow a unique determination of the nuclear charge distribution. An exponential distribution fits the data fairly well, but by adjusting parameters it may be possible to fit other distributions which do not closely resemble the exponential.

The Stanford linear accelerator produces electrons of high energy which are collimated, cleared of gamma rays, and brought to a focused spot on suitable targets. An analyzing magnet was constructed to pick up the electrons scattered from various targets and focus them on a lucite Cerenkov detector. The analyzing magnet was rotated about the targets and the angular distribution of the scattered electrons obtained.

The electrons, of energies 25, 125 and 150 Mev, are deflected away from, then brought parallel to the accelerator, through the use of a double deflecting magnet system. The parallel beam is brought to a focused spot of dimensions 3mm by 15mm. Thin foils of Au, Be, Ta, and Pb, and physically thicker foils of polyethylene, CH_2 and CD_2 were placed at this focus. The scattering chamber surrounding the foils is 20 inches in diameter. The beam passes through no windows in traveling from the accelerator to the scatterer. The vacuum in the accelerator and associated deflection equipment is of the order of 10^{-5}mm. of Hg. The scattered electrons leaving the foils pass from the chamber through a window of 6 mils of aluminum, then through 1 inch of air into a double focusing magnet of the inhomogeneous field type.[3] The solid angle of acceptance is approximately 0.005 steradians. The electrons pass through the spectrometer vacuum chamber fitted between C-shaped pole pieces. Here the vacuum is 10^{-3}mm of Hg. They leave the exit port through a second aluminum window of thickness 3 mils at the exit port, then travel through several inches of air into a truncated conical Cerenkov counter of lucite 4 inches long. A photomultiplier tube observes the pulse and feeds two counting systems: (1) a scaler gated by a 12 microsecond pulse from the accelerator trigger supply, (2) an oscilloscope and photomultiplier arrangement.[4]

The spectrometer angular resolution was ± 4 degrees in taking most of the data. Its current was held to an average of ± 0.1 percent and the width of the accepted energy band was approximately 2 percent. A 40mm naval gun mount supported the spectrometer and allowed its rotation about the fixed scattering chamber from 0 to ± 140 degrees.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

The incoming electrons had an energy spread close to 3 percent. The magnetizing current in the deflecting system was held to ±0.05 percent.

"Elastic" curves were taken at fixed angles by recording counts per unit beam against spectrometer current. With the apparatus it was possible to separate clearly the hydrogen or deuterium elastic peaks from the carbon peak in the same target. During the recording of data, several points were taken near the peak of these curves to get a good measure of the cross section.

93 pages. $1.16. MicA54-1456

1. R. Hofstadter, H. R. Fechter, and J. A. McIntyre, Phys. Rev. 90, (1953).

2. D. R. Yennie, G. Ravenhall, R. Wilson, (Letter to Phys. Rev., to be published).

3. C. W. Snyder, S. Rubin, W. A. Fowler, and C. C. Lauritsen, Rev. Sci. Inst. 21, 852 (1950); C. W. Li, Cal. Inst. of Tech., Ph.D. Thesis.

4. R. Hofstadter, and J. A. McIntyre, R.S.I., 21, 52 (1950).

PHYSIOLOGY

RELATIONSHIPS IN MAN BETWEEN THE MAXIMAL OXYGEN INTAKE AND COMPONENTS OF BODY COMPOSITION

(Publication No. 8115)

Elsworth Robert Buskirk, Ph.D.
University of Minnesota, 1954

The effects of obesity and training on maximal performance of the respiratory-cardiovascular system were studied by examining the relationship of body composition and training to the maximal oxygen intake during running. In addition, several unanswered questions pertaining to the method for determining the maximal oxygen intake were also investigated.

The subjects were 46 college students and 13 soldiers (aged 18-29) who were selected to obtain a wide sample of physical condition ranging from sedentary college students to cross-country runners and body composition ranging from 1 to 34 per cent fat. Maximal oxygen intakes during treadmill running and body densities (used to calculate body fat) were determined on all subjects. Plasma volume and sodium thiocyanate space were determined on 41 subjects and total body water on 37 subjects, thus providing a complete description of body compartments in the latter group.

The maximal oxygen procedure was carried out with the subject running at 7 mph at a grade selected according to his work capacity. The proper grade was obtained by repeated determinations at grades increased by 2.5 per cent until a satisfactory plateau of oxygen intake was achieved. A steady state of oxygen intake was attained 1 minute 45 seconds after the start of the run. No detectable change in oxygen intake took place after this time; therefore, a standard expired air collection period between 1 minute 45 seconds and 2 minutes 45 seconds was used throughout the experiment.

The mean oxygen intake elevation for a grade increase of 2.5 per cent was 4.4 cc. per kg. (range 2.4-6.4 cc. per kg.) during aerobic work. A further increase in grade, beyond the grade where an oxygen intake plateau was reached, produced a variability which did not exceed 2.6 cc. per kg. in 95 out of 100 cases. It was concluded a maximal oxygen intake had been achieved if a grade increase of 2.5 per cent produced an increment of 2.3 cc. per kg. or less.

A subject pedaling an ergometer with his arms while running on a treadmill increased his "maximal" oxygen intake by 150-200 cc.; thus, the term "maximal" oxygen intake should be qualified according to the working conditions.

The maximal oxygen intake was related to various components of body composition as shown by correlation coefficients with: body weight, 0.63; fat-free body weight, 0.85; and "active tissue," 0.91. This high correlation with "active tissue" combined with the result of increasing the mass of working muscle (arm work plus running) emphasized the importance of the size of the mass of working muscle and, in turn, the size of the vascular bed as a limiting factor determining the maximal oxygen intake.

Cross-country runners, other athletes, and relatively sedentary students used, respectively, 70.1, 57.9, and 51.8 cc. of oxygen per minute per kg. of fat-free body weight. Training, therefore, was associated with a specific change in oxygen consumption over and above the relationship shown with fat-free body weight or "active tissue." This effect was tentatively associated with the increased circulatory supply to working muscle which occurs as a result of training, since animal experiments have shown a greater vascularity in hypertrophied muscle.

Three groups of students, classified according to percentage of body fat, were compared with respect to maximal oxygen intake per kg. of fat-free body weight. No difference was observed in this ratio between the groups. Thus, it appears that the degree of fatness fails to interfere with performance of the combined respiratory-cardiovascular system under conditions of severe work.

154 pages. $1.93. MicA54-1457

PHOTOREACTIVATION IN TETRAHYMENA GELEII

(Publication No. 8213)

Eleanor Christensen, Ph.D.
Stanford University, 1954

Ultraviolet-induced delay in the division of the ciliate protozoan Tetrahymena geleii, strain W, has been reduced by post-illumination with blue light. This photoreactivation was demonstrated to occur when vigorous organisms of a fairly uniform inter-division age were used for an experiment. Monochromatic light of wavelengths 2654 A and 4350 A was used respectively for the ultraviolet injury and the blue light photoreactivation. Experimental animals were isolated singly into hanging drops of sterile bacto-tryptone medium to divide in the absence of other kinds of organisms, and their division patterns were determined from counts made with the aid of a binocular dissecting microscope at various time intervals.

A sub-lethal ultraviolet dose of 450 ergs/mm^2. of 2654 A altered the normal division pattern so that a lag occurred before the first division and a period of cessation of division usually followed the second division. The organisms would resume division after several days or sometimes weeks, depending on the physiological state of the animals at the time of irradiation. A dose of 274,000 ergs/mm^2. of blue light (4350 A) given immediately following ultraviolet irradiation decreased the amount of injury that such an ultraviolet dose would otherwise cause. Pre-illumination with the blue light, however, was ineffective in aiding recovery. Illumination of non-irradiated cells with the same dose of blue light was without effect.

The efficiency of photoreactivation by a given dose of blue light could be increased by administering the light in flashes by means of a rotating "chopper" interposed in the light path. With the intermittent blue light pre-illumination was again ineffective in decreasing the ultraviolet induced injury, and illumination of non-irradiated cells was without effect. At a constant dose of blue (1/4 (274,000) ergs/mm^2.) and a constant flash frequency (6,000 per minute) the amount of photoreactivation increased with increase in per cent of time in the dark (0.0-95.8%). With a constant light period (0.0025 second), a constant dose of blue, and the time of the dark period being varied from 0.0-0.0575 second, the time for the dark reaction of photoreactivation to reach completion at room temperature (21-24^0 C.) was determined to be of the order of hundredths of a second. The efficiency of a given dosage of photoreactivating light was also dependent on the intensity of the blue light. In the range of intensities studied (35.8 to 453. ergs/mm^2./sec.) the amount of photoreactivation was greatest with the lowest intensity.

The amount of injury produced by the ultraviolet dose of 450 ergs/mm^2. was dependent on the intensity of the ultraviolet light beam; a low intensity of 1.5 ergs/mm^2./sec. or a high intensity of 19.0 ergs/mm^2./sec.) produced less injury than an intermediate intensity of about 8 ergs/mm^2./sec. Flashing of a given dose of ultraviolet light increased the amount of injury only for the high intensity of 19.0 ergs/mm^2./sec.

The experimental results indicate that for Tetrahymena both the ultraviolet injury system and the photoreactivating system involve photochemical reactions followed by thermal (dark) reactions.

125 pages. $1.56. MicA54-1458

A STUDY OF RIBONUCLEASE AND DESOXYRIBONUCLEASE DURING THE EARLY DEVELOPMENTAL STAGES OF RANA PIPIENS

(Publication No. 8170)

Frank Joseph Finamore, Ph.D.
Florida State University, 1954

A spectrophotometric method for the determination of ribonuclease and desoxyribonuclease activities was developed. With this rapid method it was possible to measure enzyme activity at short time intervals during the early development of the frog. It was found that ribonuclease activity increased progressively throughout cleavage and reached a maximum during early blastulation. From mid-blastulation through the beginning of gastrulation, there was a rapid decrease in ribonuclease activity. At mid-gastrulation, the activity abruptly increased to a maximum value and then declined until just prior to neural plate formation. At this time, the activity again increased rapidly but soon declined when the neural plate became evident.

Desoxyribonuclease activity declined slowly during cleavage and early blastulation but during mid-blastulation, there was an abrupt increase in activity which reached a maximum at the beginning of gastrulation. It then declined sharply to a minimum value during the early gastrulation stages. At mid-gastrulation, there was another rapid increase in desoxyribonuclease activity which reached a maximum and then declined until just prior to neural plate formation, at which time a slight increase in activity was seen.

59 pages. $1.00. MicA54-1459

SOME FACTORS INFLUENCING THE RENAL EXCRETION OF SODIUM

(Publication No. 8120)

Rodney Bryce Harvey, Ph.D.
University of Minnesota, 1954

This thesis is a further study of the relationships between the urinary excretion, glomerular filtration, and tubular reabsorption of sodium in intact unanesthetized dogs. These relationships were studied during natriuresis produced by the infusion of mannitol and sodium chloride solutions. The infusion of 1.3 molar mannitol solution at a rate of 0.44 ml per

minute per kilogram of body weight produced a marked increase in plasma osmotic activity as measured by the vapor tension method. Accompanying the increase in plasma osmotic activity there was a rapid increase in renal excretion of water, sodium, potassium, and total solutes. The increased water excretion was associated with a decreased tubular reabsorption of water. The glomerular filtration rate, as measured by the clearance of creatinine, was not changed measurably. The osmotic activity of urine during hypertonic mannitol infusion remained below that of the plasma. The increased sodium excretion was associated with a significantly decreased rate of tubular reabsorption of sodium.

Changes in kidney functions produced by a rice diet and a diet of horsemeat and 2.2 grams of sodium chloride per kilogram of body weight per day were measured. A standardized infusion of mannitol was given after feeding each of these diets for seven days. The glomerular filtration rate was found to be lower after the dogs had been fed a rice diet. In the rice diet experiments the calculated concentration of sodium in the reabsorbate increases during mannitol infusion to concentrations higher than those found in the plasma. However, after feeding excess sodium the concentration of the sodium in the reabsorbate showed a much smaller increase, yet the acceleration of sodium excretion was more rapid.

If the rate of intravenous infusion of sodium chloride solution, having a concentration of less than 0.200 moles per liter, is slowly increased over a period of several days, a dog is able to increase the rate of sodium and water excretion greatly. During such infusion the rate of sodium excretion may rise to 0.13 millimoles of sodium per minute per kilogram of body weight. The daily turnover of sodium may be three times the calculated total body sodium content. The rate of excretion of water may increase to 0.72 ml per minute per kilogram of body weight or 103% of body weight per day. At these very rapid rates of excretion of sodium and water the dogs showed a weight gain of less than 3% body weight. Plasma sodium concentration was elevated by 15 millimoles per liter or less. After steady states were reached, further changes in the excretion of sodium and chloride were induced by altering the concentration of sodium chloride in the infusion fluid. The changes in excretion of sodium chloride thus produced were found to be most strongly correlated with changes in the rate of filtration of sodium. Changes in glomerular filtration rate and increases in plasma sodium were more than enough to account for the increase in excretion.

It may be concluded that it is improper to expect to find that sodium excretion rate changes will always be determined by the same factor or factors. In the observations reported it is apparent that the mechanisms of natriuresis in the case of chronic saline infusion differ from those of mannitol infusion. In the former one finds that tubular reabsorption fails to keep up with increases in rate of filtration of sodium. In the latter case, despite a tendency for a decrease in filtration rate of sodium, there is an increased sodium loss that can only be interpreted as a decreased rate of sodium reabsorption.

130 pages. $1.63. MicA54-1460

FACTORS INFLUENCING THE CONTINUOUS RECORDING OF THE IN-SITU pH OF GASTRIC AND DUODENAL CONTENTS IN NORMAL PERSONS AND PATIENTS WITH DUODENAL ULCER

(Publication No. 8140)

Randolph Andrew Rovelstad, Ph.D.
University of Minnesota, 1954

Only four groups were found to have reported their use of an in-situ technique for measurement of the pH of gastrointestinal contents. In common, these workers were troubled with electrode failure, bulky apparatus, unknown junction potentials, and uncertain contact sites for the reference electrode. Data were meager. If the potential difference between skin and intestinal tract were known the reference cell could make contact with the skin and only the glass electrode need be swallowed. This would appreciably reduce bulk. Therefore a double lumen plastic tube was designed to circulate saturated KCl to a terminal capillary contact within the gastrointestinal tract. The unabraded finger was immersed in saturated KCl and potentials from these two sites were led through calomel cells to a continuously recording high-impedance millivoltmeter. In 14 normal human subjects mean intraesophageal potential was +12.8 mv (range: +25 to -2); mean intragastric potential: -22.3 mv (range: -37 to -7); mean intra-duodenal potential: +16.4 mv (range: +30 to +4). The duodenal site was more positive than the gastric site by 44 mv (S.D. 7), a fact highly reliable in determining the electrode position. Excitement was found to decrease the skin-enteric potential difference. With a calomel cell's making skin contact, intraesophageal pH, therefore, would be in error -0.4 to +0.03 pH, intragastric pH +0.6 to +0.1, and intraduodenal pH -0.07 to -0.5 units. Potentials between two intraenteric as well as between skin and intraenteric sites were fluctuant. The cause of this instability could not be determined with certainty but not excluded were "suspension" effects of mucus, and variable immersion in a juxtamucosal cation zone. In 15 additional normal human subjects, using an in-situ glass electrode, pH near the pylorus often varied by as much as 5 units at a rate of 2-3 times per minute. Duodenal records were more stable without special characteristics near the Ampulla of Vater. A shield over the electrode was essential to the recording of increased duodenal acidity after histamine, apparently through prevention of mucosal contact with the electrode. Shifts in pH baseline with periodic switching from intraenteric to cutaneous contact for the reference half-cell proved helpful in determining electrode position. Duodenal pH was raised and stabilized after emesis or during sleep.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Twenty-four patients with duodenal ulcer were then compared with a control group of 25 patients having the "irritable bowel" syndrome.

In the ulcer group the mean pH of fasting gastric contents was 1.38 (S.D. 0.235) as compared with 3.43 (S.D. 1.81) in controls. For fasting duodenal contents the respective means were 5.88 (S.D.0.9) and 6.15 (S.D. 1.26). After histamine the mean pH of duodenal contents was 4.67 (S.D. 1.16) in the ulcer group and 6.24 (S.D. 1.32) in controls. The ulcer group thus revealed significantly greater acidity of fasting gastric and posthistamine duodenal contents but no difference in fasting duodenal contents. Titratable gastric acidity following a test meal was poorly correlated with in-situ pH. A titratable gastric acidity below 40 units or a rise in duodenal pH after histamine were found with similar infrequency in the presence of active duodenal ulceration. After histamine, duodenal pH fell below 4.0 43% of the time in patients with duodenal ulcer; only 15% in the controls, a significant difference. There being no adequate data from other in-situ pH studies our results were compared with Kearney's obtained by continuous aspiration of the ulcerated duodenum with external pH measurement. In our series of ulcer patients the in-situ method gave higher fasting pH values in the duodenum than did Kearney's technique, which may have unphysiologically reduce intra-duodenal pressure and facilitate entry of gastric fluids. After considering the technical limitations of in-situ pH measurement the technique is felt to have valuable investigative applications.

107 pages. $1.34. MicA54-1461

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

INTERGOVERNMENTAL RELATIONS IN THE FIELD OF PUBLIC AIRPORTS IN MINNESOTA WITH SPECIAL REFERENCE TO RELATIONS BETWEEN THE STATE DEPARTMENT OF AERONAUTICS AND THE METROPOLITAN AIRPORTS COMMISSION

(Publication No. 8113)

Gary Philip Brazier, Ph.D.
University of Minnesota, 1954

The acquisition, construction, and improvement of public airports are governmental services that involve the national government, many state governments, and a large number of local political subdivisions. Relations among such governments in these services are dynamic and offer many illustrations of the substance of the federal system as it operates in the United States.

Minnesota is one of the leading states in the provision of both financial and technical assistance to local government units engaged in public airport services. These aids, coupled with the offers of Congress to share local concerns in the airport field, have increased the scope and extent of intergovernmental relations among all three levels of government. The problem of airports is primarily a money problem. Since acceptance of either state or national funds by local governments provides legitimate bases for state or national conditions affecting the expenditure of such funds, local governments must weigh their needs for money to participate in airport operations against the prospects of the loss of discretionary authority. Minnesota experiences in this field indicate that the strength of conviction of local governments claiming advantages of local autonomy vary in direct proportion to their financial ability. Such local units have accepted offers to share responsibility with others when local resources are inadequate, but one reservation must be made. The price of sacrificing local judgments to outside capital and outside authority cannot be set too high or those offers to share local concerns will be rejected.

Financial resources are not the only factors that affect the relations among the several governmental levels, for, as the Minnesota situation demonstrates, the factor of personality can be decisive. Because governmental policies cannot be finally determined by legislative bodies, the importance of administrative organization cannot be overlooked. The two most prominent aviation agencies in Minnesota are the State Department of Aeronautics serving the whole state and the Minneapolis-St. Paul Metropolitan Airports Commission which is empowered to act in the metropolitan area. Relations between the two have not been friendly despite the fact that both bodies have similar objectives and are directed by administrators who presumably speak the same professional language. There have been the usual charges of excessive state control over the largest cities in the state and the customary regard of municipal corporations as legal creatures of the central authority, but the most serious difficulties between the local body and the state have developed because the administrators of the respective programs have held essentially competitive philosophies respecting the proper role of government in airport service activities. Seldom have the two agencies worked together without friction to attain their common goals.

Issues of centralized versus decentralized performance of airport functions are complicated further by the willingness of the national government to accept some financial responsibility for the provisions of service facilities. Introduction of federal aid into the Minnesota airport picture has resulted in increased tension between the state agency and the Metropolitan Airports Commission; pragmatic

study of the administrative activities of all three participating governments provides considerable insight into the functioning of twentieth century federalism. 258 pages. $3.23. MicA54-1462

DEMOCRATIC TRADE UNIONISM IN POSTWAR ITALY

(Publication No. 8079)

Joseph Guido La Palombara, Ph.D.
Princeton University, 1954

Efforts in Italy to create non-Communist trade unions date from the disintegration of the united labor front in 1948. Unscrupulous Communist domination of the Italian General Confederation of Labor (CGIL) became progressively intolerable to certain political parties, and to the United States when the controlling faction within CGIL expressed opposition to the Marshall Plan. Beginning in 1948, therefore, American officials and trade unionists joined forces with several Italian political factions in a campaign to establish in Italy labor unions which could compete effectively with CGIL.

Two major labor confederations have arisen to challenge Communist supremacy. The Italian Confederation of Workers' Unions (CISL) is essentially an adjunct of Christian Democracy and also receives the lion's share of the assistance provided by the American government and by the AF of L. The Italian Union of Labor (UIL) consists of Democratic Socialists and Republicans who are opposed by the above but favored by the CIO. The unfortunate antagonism of the American government toward UIL derives largely from a pattern of distorted reporting which has developed at Rome.

Both CISL and UIL are encumbered by growing pains, a dearth of able leadership, a lack of dynamic programs, and financial insufficiency. Moreover, the administrative structures of both are very crude and often shot through with opportunistic leaders who have been appointed on the basis of particularistic criteria. Although CGIL both of these confederations appear as amateurish and, what is more important, as incapable of obtaining the initiative within the sphere of labor activities.

The apparent inability to compete with CGIL, however, stems from other sources as well. Internationally, Italy remains submerged in a morass of economic, social, political and demographic problems upon which the Communist unions are able to capitalize. Overpopulation, rampant unemployment, regressive taxation, a relatively stagnant economy, a rigid social structure and a basically conservative government are only a few of the factors working in CGIL's favor.

American intervention is also responsible for CGIL's continuing domination. The assumption that apolitical trade unionism is possible in Italy is largely unjustifiable; yet American officials and trade unionists continue to insist on it. This is especially damaging since CISL itself is manifestly an instrument of the Christian Democratic party. Refusal to lend large-scale support to UIL has been almost suicidal because the many Italian Socialist workers who might leave CGIL for a strong Democratic Socialist confederation will certainly not go all the way over to CISL. The attempt to create a "red" or "white", bi-polar choice for Italian labor simply has not worked. Undue interference with the policy-making functions of CISL has also had its deleterious impact. Above all, however, American policy aiming at social change through the free trade unions has been inexpert, or at least lacking in long-range perspective. The abortive campaign to increase Italian productivity is a good example of this operational shortcoming. American governmental and trade union policy affecting Italian labor has not, as the evidence demonstrates, been based on a careful articulation of problems, an enumeration of policy alternatives and an analysis of the possible consequences of particular action.

The situation for free labor in Italy is critical. If any genuine progress against CGIL is to be made, there must be a complete reevaluation of policy, a restaffing of foreign personnel on the part of the government and American trade unions, a reappraisal of the utility of pouring an endless stream of dollars into trade unions whose value to the Italian worker is highly dubious, and above all, a serious attempt must be made to approach the complex problems of social change in a more sophisticated and realistic manner. 411 pages. $5.14. MicA54-1463

THE LEGAL STATUS OF AMERICAN AND MEXICAN MIGRATORY FARM LABOR: AN ANALYSIS OF U. S. FARM-LABOR LEGISLATION, POLICY AND ADMINISTRATION

(Publication No. 8197)

Richard Martin Lyon, Ph.D.
Cornell University, 1954

This dissertation is devoted to an analysis of the legal and legislative facets of the migratory labor problem in American agriculture. The problem of migratory farm labor has been presented as a case of "rightlessness" under the law and underprivilege and exploitation within the agricultural economy.

The migrant farm labor force totals about 522,000 native Americans, some 200,000 Mexican contract workers, and additional small numbers of British West Indians, Puerto Ricans and Canadians. There are also in excess of 1,500,000 Mexican "wetbacks" illegally working in this country, concentrated in the Southwest.

Federal and State labor policy for all practical purposes is directed toward industrial labor only. Migrant farm workers, in common with non-migratory hired agricultural labor, are generally denied the protection and benefits of labor relations laws and of protective labor legislation. Mexican workers contracted in the United States-Mexican Farm Labor

Program receive more guarantees and better protection than do the native American farm migrants. Originally the Mexican importation program had been used as an emergency measure during the World War II to provide an orderly supplement to the inadequate farm workforce of the United States. Now it has taken on the features of a quasi-permanent official national farm labor policy. Post-war importations have been over three times the war-time high. The development of this program under Executive Agreement is subjected to a legal and historical analysis in the thesis.

The two basic interests - organized agriculture and organized labor - differed considerably on the execution of this undertaking with Mexico. The major postwar debate over farm labor policy culminated in Public Law 78 (82nd Congress, 1st Session), a legislative history of which is herein presented. This law, implementing the Executive Agreement, contains two major drawbacks in the opinion of the writer: a) preferential treatment is accorded to foreign farm labor over American workers in the area of labor standards; and b) the law fails to deal adequately with the problem of the wetback workers, whose number is over five times that of the legally introduced Mexican labor. While no objection is registered against the importation of foreign labor when actually needed, in the opinion of the writer a legal farm labor importation program was not an end in itself to the farm interests. On the basis of evidence mustered the author would deduce that one of the primary functions of the importation program is to permit the continuation of wetback employment, and its depressing effect on certain sections of the country's agriculture.

In search of a "solution" toward improving the migrant's life the author reviews the history of the Federal migrant labor policy during the past 50 years. It is noted that all official investigating groups saw migrant labor policy to be of national scope, and have accordingly recommended intervention by the Federal government. During the last decade, however, emphasis has shifted from social legislation to concentration on rationalization of the administration of migrant farm labor policies. Different patterns of migrant labor administration are discussed; in addition to the Federal scheme, the author examines the operations of the New York State Interdepartmental Committee on Farm and Food Processing Labor and of the New Jersey Migrant Labor Board.

The author's proposal is an interstate regulation of recruitment, transportation and placement of migrants on a regional or area basis by Interstate Compact — a device midway between exclusive Federal and exclusive State control. This compact would be concluded between States drawing their workforce from the same source and dependent on each other for harvest labor. The country would eventually be divided into a number of regions coterminous with the customary migratory routes.

655 pages. $8.19. MicA54-1464

THE AIR CORPS ACT OF 1926; A STUDY OF THE LEGISLATIVE PROCESS

(Publication No. 8085)

Harry Howe Ransom, Ph.D.
Princeton University, 1954

The use of aircraft in the first World War was a technological development of far-reaching significance. The potentialities of aviation, as seen by some in the post-war period challenged existing military organization and doctrines of warfare in the United States.

Proposals for change resulting from a belief in aviation's potential, suggested by war-time experiences, came in a period of American governmental retrenchment, anti-foreignism, international independence and nationalism. The League of Nations as an instrument of security was rejected and emphasis was placed on disarmament pacts and the search for substitutes for war other than the collective security proposals of Woodrow Wilson.

There was constant agitation in the post-war period by "air radicals" led by William Mitchell, for basic changes in American military doctrines and organization. Underlying these arguments was the insistence upon the idea of an independent mission for aviation, an idea which was developing into the doctrine of strategic warfare. The established older services - the ground forces of the Army and the Navy's surface forces - refused to accept the doctrines being propounded by air enthusiasts. Aviation was officially regarded as essentially an unstable auxiliary device to be used with the well established surface forces.

Thus developed a struggle between the old and the new - a struggle between conflicting interpretations of the "lessons of the war" regarding aviation. The conflict soon developed into a legislative struggle. For in the Congress, under the American system of government, lies the final legal authority for determining the size, organization, and in effect the major military doctrines of the armed forces. Congressional debate on the national defense structure beginning in 1919, evolved around several basic proposals for change, namely: for a United Air Service, for an Independent Air Service, or for a Department of Defense, with the aviation service on an equal basis with the Army and Navy. Such proposals produced bitter controversies as well as a large number of Congressional, Presidential, and military investigations, studies, and reports.

Debate over national defense neared a climax in the fall of 1925, precipitated by a series of events, including the diaster involving the naval airship Shenandoah and the subsequent attack by Mitchell upon the leadership of the defense establishment; the Morrow Board investigation and report following the dramatic turn of events; and the report of a House Select Committee, which recommended the establishment of a Department of National Defense.

In the face of these incidents, which had culminated in the sensational military trial and conviction of Mitchell; the Morrow Board refutation of most of Mitchell's major contentions; and the House Select

(Lampert) Committee's recommendations, the 69th Congress was pressured into a major decision on national aviation policy in its first session.

An analysis of the history, setting, and major issues engendered in this controversy and the resultant Congressional decision-making indicates that the major incentive for Congressional decisions was provided by the Morrow Board. Although there was strong support in Congress, particularly in the House Military Committee, for the main tenets of the air radicals, the forces arrayed against basic change proved to be stronger than those advocating alterations in military doctrines and organization. The resulting legislation, the Air Corps Act of 1926, was therefore a compromise favoring the status quo. But the act gave, at the same time, some recognition to the doctrines and organizational suggestions of the air enthusiasts. The act also stimulated the development of military and commercial aviation within the existing structure.

This study has further suggested:

1. Military institutions, as vested interests, are slow to accept sometimes obvious technological advancements.

2. Congressional decision-makers are heavily dependent upon the advice of experts, but are also individually identified with the various interest groups in the legislative struggle. When experts disagreed, as they did, on the question of national security, both the dilemma and power of the Congressional decision-makers was increased.

3. In such a situation, however, a non-congressional composite group, representing various "vested interests" (although it may be questioned whether the "air radicals" were truly represented) took the initiative and, in the last analysis, was the most significant group in the determination of policy in the 1926 legislative decisions. This was the presidentially-appointed Morrow Board.

4. While the report of the Morrow Board was the major source of the Air Corps Act of 1926, the House Military Committee positively and the Senate committee negatively, as well as the Senate-House conference committee, contributed to the final form of the act. Yet in reality Congress played a secondary role in the determination of policy.

5. A "vested interest" concept seems to be the key to the rigidity of the institutions under study, with a major role of Congress being that of "referee" or "broker". The combined strength of the Army-Navy bloc, with Presidential support, maintained the "vested interests" and sustained the status quo.

6. The power of Congress to make a final determination of military policy is conditioned by its access to information; the aura of competence and the real power held by the various contending groups, including the Congressional committees; the two-party balance of power and the amount of residual power held by the president; and the "temper of the times." The legislative process under study has shown itself to be made up of complex action and interaction by individual and social forces. The lines of authority of executive - legislative - military institutions are intertwined and no clear "separation of powers" or "civilian control of the military" existed in actuality. 410 pages. $5.13. MicA54-1465

PSYCHOLOGY

PSYCHOLOGY, GENERAL

DEVELOPMENT OF A PERSONALITY TEST FOR EXECUTIVE SELECTION

(Publication No. 8058)

Samuel Nowell Stevens, Ph.D.
Purdue University, 1954

Major Professor: Joseph Tiffin

Experimental results in the field of selective perception are used in constructing a personality test for executive selection. The test was administered to the management group of a large industrial concern and the results were analyzed.

Twenty-four scoring indices were developed and tested on a primary group of 144. Seventeen of the indices were found to bear a statistically significant relation to a criterion of executive potential. An overall scoring system utilizing all indices found significant on the primary group was developed and applied to a holdout group of 143 persons.

Analysis of results obtained with the holdout group indicates that the test is of use in prediction of ratings of executive potential. The test was found to increase the efficiency of a test battery including a test of mental ability, a test of vocabulary, and a test of clerical ability.

45 pages. $1.00. MicA54-1466

PSYCHOLOGY, CLINICAL

A LONGITUDINAL STUDY OF VOCATIONAL INTERESTS DURING THE DEPRESSION YEARS

(Publication No. 8136)

Mabel Kathryn Powers, Ph.D.
University of Minnesota, 1954

The primary purpose of the present study was to determine the degree of permanence of vocational interests of adult males, as measured by the Strong Vocational Interest Blank (SVIB), and the relationship between permanence of interests and specific data from the SVIB as well as from the occupational history. A secondary purpose was to determine the

relationship between occupational stability and specific data from SVIB.

The subjects were 109 males from the Minnesota Employment Research Institute sample on whom SVIB results were available for 1931 and for 1941. They ranged in age from 16 to 63 years in 1931 with the majority in the skilled, semi-skilled, and unskilled occupations.

The two Strong Blanks were scored on 44 occupational interest scales and on the Interest Maturity (IM), Occupational Level (OL), and Masculinity-Feminity (MF) scales. Number of Primary (P), Secondary (S), Tertiary (T), and Reject (R) patterns in the 11 SVIB occupational interest groups were determined. The occupational histories were analyzed for modal occupation, level, and stability of employment, and congruence of occupation and measured interests.

The permanence of vocational interests of individual subjects was determined by rank-order correlation between test-retest standard scores on the 44 occupational scales and by the sum of the differences in the two testings between level of group patterns (P,S,T,R) for each individual in each of the 11 occupational interests groups of SVIB.

Permanence of interests of the total group was measured by product-moment correlation between test-retest standard scores on each of the 44 occupational interest scales and by the differences between mean test-retest standard score on the same scales. Percent of overlap was computed for the scales which showed statistically significant differences. The permanence of scores on the non-occupational scales was tested by the same methods.

The method of Chi-square was used to test the relationships between permanence of vocational interests and level of employment, stability of employment, congruence of interests and modal occupation, age (1931), IM score (1931) OL score (1931), and number of P,S,T, and R patterns (1931) and relationships between stability of employment and IM score (1931), OL score (1931), congruence of interests (1931) and occupation, and number of P,S,T, and R patterns (1931).

On the basis of the results obtained, the following conclusions seem warranted for the population studied.

1. The rank-order of 44 occupational interest scores was remarkably stable for the overwhelming majority of subjects.
2. There were very few differences in level of pattern on the 11 interest groups for each individual.
3. The total scores on each occupational interest scale for the group at the beginning and the end of the period were highly correlated.
4. Difference in mean scores was statistically significant at the .01 level for only 14 of the 44 scales. The lowest percent of overlap on any scale was 87, indicating no difference of practical significance.
5. No relationship existed between permanence of vocational interests and level of employment, stability of employment, congruence of interests and occupation, age, IM scale, or OL scale.
6. Those individuals exhibiting the greatest permanence of vocational interests had significantly more Primary patterns and significantly fewer Tertiary patterns than did those individuals whose vocational interests were less permanent.
7. Employment stability was unrelated to IM scale, OL scale, congruence of interests and modal occupation and number of P,S,T, and R patterns.
8. Age and IM scores were unrelated.

Although the results of this research cannot necessarily be considered applicable to all men in the general population or to other periods of time, they are considered significant in indicating that vocational interests of these adult males remained highly permanent during a period of severe economic depression and unemployment.

171 pages. $2.14. MicA54-1467

EGO-STRUCTURE OF REBELLIOUS ADOLESCENTS: AN EXPERIMENTAL STUDY OF THE DYNAMICS AND ETIOLOGY OF ASOCIAL BEHAVIOR

(Publication No. 7509)

Eva Maria Shippee, Ph.D.
Stanford University, 1954

The investigation considered the dynamics and etiology of asocial behavior. The experimental findings and theories concerning juvenile delinquency were extended to a more nearly average group of rebellious adolescents. To this end a psychoanalytic frame of reference was adopted which provided the common denominator "impaired ego-strength" as the inferred dynamic factor in both juvenile delinquency and rebelliousness.

A number of specific sub-hypotheses were derived linking impaired ego-strength to lessened tension-binding-capacity, defective super-ego functioning, lack of sublimation capacity, and narcissistic self-regard. The hypothesis of a corresponding ego-weakness in the parents manifesting itself in extremes of tension-binding-capacity, combined with strictness of parental discipline as well as inconsistency of discipline was advanced as one of the etiological factors in the production of ego-weakness in the child.

To test these hypotheses a sample of 131 freshman and sophomore students in regular attendance at a suburban highschool was divided into three groups on a continuum of asocial behavior. Teachers' rankings of behavior in class, citizenship grades, and presence or absence on the Deans' black-lists provided the three criteria used in the categorization of the sample into a group of forty-eight Rebels, fifty Moderates, and thirty-three Cooperators. In the final sample of eighty-one subjects only the two extreme groups of thirty-three Cooperators and forty-eight

Rebels were retained. The middle group of fifty Moderates was eliminated from the final sample.

The four hypotheses regarding impaired ego-strength in the Rebel were tested experimentally in the following predictions:

Lessened Tension-Binding-Capacity — Prediction I related the subject's tendencies toward under-control as measured by an attitude questionnaire, to rebelliousness.

Defective Super-Ego Functioning — Prediction II related a weak ego-ideal as measured by the ratio of the subject's parent-esteem to his self-esteem, to rebelliousness.

Lack of Sublimation Capacity — Three areas in which the lack of sublimation capacity may manifest itself were investigated. The prediction (III) that aggressiveness would be revealed in the Rebel's responses on a drawing task was tested. Lower school achievement in spite of equal intellectual capacity in the Rebel was tested in prediction IV. Prediction V related low sublimation capacity as manifested in low interest in preferred activities on the Kuder Preference Record, to rebelliousness.

Narcissistic Self-Regard — In prediction VI narcissistic over-evaluation of the self and unrealistic feelings of inferiority as measured by extreme self-esteem scores obtained on an adjective check-list, were related to rebelliousness.

The experimental results supported all six predictions significantly. It was concluded that our findings may be interpreted as supportive of our basic hypothesis of impaired ego-strength in the Rebel in a number of ego-functions necessary for satisfactory social adjustment.

Parental Attitudes — The importance of parental attitudes in the etiology of asocial behavior was tested in the following predictions: Prediction VII related the parents' overt attitude of greater strictness in matters of discipline to rebelliousness in the child. Prediction VIII related parental tendencies toward over-control to rebelliousness in the child. Prediction IX related greater overt inconsistency between parents in matters of discipline, to rebelliousness in the child. Prediction X related greater covert divergence in ego-control between parents to rebelliousness in the child.

The data supported the predictions concerning parental attitudes as measured by questionnaires, only partially. Predictions VII and X were significantly sustained by the experiments. However, prediction VIII and IX failed to be verified by experimental tests.

Parental Ego-Weakness — The hypothesis of a corresponding ego-weakness in the parent of the rebellious child was tested in the prediction (XI) that extremes in parental tension-binding-capacity as measured by extremes in ego-control scores, are related to rebelliousness in the child.

The results supported this hypothesis in the case of both the mothers and the fathers of the Rebels.

The trends observed in the parents' data indicated the possibility that restrictive attitudes toward discipline in parents who show tendencies toward ego-weakness, either in the under- or the over-controlling direction may be interpreted as factors in the etiology of rebelliousness.

These conclusions are subject to the restrictions imposed upon them by the nature of the experimental design and the limits of the instruments employed in testing the hypotheses. The method employed in this study illustrates the feasibility of conceptualizing some of the underlying dynamics of behavior in terms of the hypothetical construct "ego-strength." Discrete and opposite behavioral manifestations can be organized using this theoretical frame of reference. Such a conceptualization suggests a number of areas for further research and highlights some of the pertinent factors in the rehabilitation of juvenile delinquents and in the prevention of asocial behavior.

163 pages. $2.04. MicA54-1468

INTELLECTUAL FUNCTIONING AS RELATED TO ELECTROCONVULSIVE THERAPY

(Publication No. 7765)

Katherine Washburn Wilcox, Ph.D.
University of Michigan, 1954

The three problems investigated in this study all pertained to the effect of one type of electroconvulsive shock treatment (ECT) on the efficiency of mental functioning. It was predicted that intellectual functioning would show a temporary decrement tending to be reversible within an hour following a single ECT; that the decrement would tend to be cumulative with a series of ECT's; and that the decrement following a series of ECT's would be temporary and would be reversible within two weeks following the end of the series of ten treatments.

Two programs of testing were carried out to provide the data for the evaluation of these directional predictions. A short battery of five brief tests was administered individually three consecutive times at 15 minute intervals to 23 women patients at the Traverse City State Hospital as soon as each was awake after the first, fifth, and tenth ECT's. The short battery included the Niver block, serial sevens, Stroop color naming, and the copying of Bender designs 6 and 7. The longer battery of tests included all of the short battery and also the Shipley-Hartford scale, the Fairfield block substitution scale, and two tests of easy arithmetic. This longer battery was administered four times: before ECT, one day after a series of 10 ECT's, two weeks after, and three months after. Test-retest r's at a ten-week interval for 23 convalescent psychotic patients ranged from .78 to .88 for 8 of 10 measures. The Reiter Electrostimulator was used as the source of stimulation for the treatments, and a grand mal tonic-clonic convulsion always occurred. The findings of this study are limited to this method.

During the post-convulsive hour the mean changes in intellectual functioning showed a significant decrement ($P = .005$) for the first quarter-hour, an equally significant improvement for the second quarter-hour,

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

then a more gradual improvement for the third quarter-hour. By the end of 45 minutes after the patients were awake, three of the five measures showed essential recovery to the pre-ECT level. From the first to the tenth treatments, all of the measures showed some decrement, significant for two of five. From pre-ECT to one day after the ECT series every measure showed a decrement in performance, significant for five of ten. Two weeks later, nine of the ten measures showed more improvement than could be attributed to practice. Three months later there was a further slight improvement, usually not significant. These score changes were accompanied by clinical improvement. The findings supported all three directional predictions.

Ancillary findings were inconclusive as to the differential effects of ECT on easy and difficult tasks, and on concrete and abstract thinking. Performance on the measures of old and new learning were both influenced, but new learning to a greater degree than old learning. 207 pages. $2.59. MicA54-1469

PSYCHOLOGY, EXPERIMENTAL

BLOOD CHANGES DURING EMOTIONAL STIMULATION IN THE GOAT

(Publication No. 8194)

James David Block, Ph.D.
Cornell University, 1954

This study primarily investigates the role of the sympathico-adrenal-medullary system during avid eating and "handling". The removal of an animal from its living quarters and the placing of it on a stand in the experimental room constitutes handling. Physiological measures used are: plasma potassium and sodium, red blood cell volume-per cent, eosinophile count, heart rate, and adrenergic and cholinergic blood substances detected by the reactions of an isolated segment of rabbit jejunum.

It is found that plasma potassium varies significantly after either handling or eating. An immediate rise is followed by a fall below pre-stimulation levels within 10 minutes. However, plasma sodium shows small variations diametrically opposed to potassium, which are significant only for a large number of observations over a period of 4 hours including both types of stimulation. Red blood cell volume-per cent values essentially parallel those of plasma potassium after stimulation. Both red blood cell volume-per cent and plasma sodium values show a day-to-day decrease, whereas plasma potassium values show no consistent pattern.

Heart rate, which is known to be increased by exogenous and endogenous adrenaline, is shown to be increased immediately after, and 1 minute and 5 minutes after the presentation of food.

Eosinophile count in the goat is found not to decrease within 4 hours after handling, but a significant decrease is observed 24 hours later. Thus, in contrast to some other species, the eosinopenic response in the goat is extremely sluggish.

A standardized method for the single-dose assay of noradrenaline and acetylcholine on the rabbit jejunum is developed. A total of 480 separate assays demonstrates the extremely large error of such an assay method. The failure of the method to detect increases in total adrenergic activity of plasma after noxious stimulation is ascribed to this large error of assay. However, using the rabbit segment, the average adrenergic activity of blood can be calculated. In 1.0 cc. of whole blood the adrenergic activity of the plasma contained is estimated to be .024 gamma l-noradrenaline equiv.

Plasma concentration of a substance which produces contraction of this segment treated with hyoscyamine is found to vary with environmental stimulation. The substance, apparently a normal concomitant of the placid state, is significantly decreased after handling in the newly trained animal. However, after the animal behaviorally demonstrates habituation to the experimental situation, the substance no longer decreases after handling. Now, however, a decrease can be detected within one half hour after the presentation and subsequent ingestion of food. In addition, plasma is also found to contract the normal segment. However, degree of concentraction in the normal segment bears no relation to environmental stimulation. Therefore, the existence of two distinct contractile substances in plasma is indicated.

It is concluded from the similarity of the results found here to the known effects of exogenous adrenaline on plasma potassium, red blood cell volume-per cent, and heart rate, that both avid eating and handling by the experimenter increase activity of the sympathico-adrenal-medullary system in the goat.

104 pages. $1.30. MicA54-1470

PERCEPTUAL CONSTANCY IN SCHIZOPHRENICS AND "NORMALS"

(Publication No. 8055)

Gerald A. Reynolds, Ph.D.
Purdue University, 1954

Major Professor: Franklin J. Shaw

This study was intended to test the hypothesis that schizophrenics will perceive in retinal fashion, while "normals" will perceive in constant fashion, in situations supposedly demanding perceptual constancy. The population consisted of sixty male subjects. The "normal" and three schizophrenic groups, paranoid, hebephrenic, and catatonic, each contained fifteen subjects.

Familiar and unfamiliar materials were used in different situations. The "normals" would supposedly be predisposed to perceive the familiar material in more constant fashion than the unfamiliar material. The schizophrenics were expected to perceive both the familiar and the unfamiliar materials in retinal, or non-constant, fashion.

Binocular distance cues were absent in all of the experimental situations. The "normals" were expected to be more dependent on distance cues than were the schizophrenics. The absence of binocular distance cues, therefore, was expected to also predispose the "normals" toward more constant perception than that of the schizophrenics.

Size and distance estimates were asked of all subjects for all distances and situations employed. An apparent visual angle was computed for each size and distance given. The reactions of the "normals" and the schizophrenics were examined by means of analysis of variance.

Results indicated that size and distance estimates taken separately did not differentiate between the reactions of the schizophrenics and the "normals" with respect to the predicted retinal and constant perception. The visual angle did, however, differentiate the two groups along these lines. It was concluded that consideration must be given to the reaction to constancy factors, shown by the size of the apparent visual angle, as well as to whether or not retinal or constant perception was used during the changes in the situations. It was found that the normal subjects did not respond to changes in the situations by perceiving in constant fashion as predicted. The schizophrenics actually perceived in more constant fashion in this respect. The "normals" did, however, show a reaction to the constancy factors in the predicted fashion. That is, they gave larger visual angles for the familiar material than they did for the unfamiliar material. The reverse is true of the schizophrenics. An attempt was made to explain these phenomena and to include the results of this study in a reformulation of the initial theory.

63 pages. $1.00 MicA54-1471

VALIDATION OF CERTAIN TESTS OF OCULAR DOMINANCE AGAINST A CRITERION OF BOMBSIGHT DESIGN PREFERENCE

(Publication No. 8141)

Bertram Joseph Smith, Ph.D.
University of Minnesota, 1954

The object of this investigation was to examine the validity of two different tests of ocular dominance. The tests selected were the Porta-Rosenbach test, which is a "free-choice" test, and the Miles ABC test, a "forced-choice" test. A forced-choice test forces the subject to sight with one eye or the other by using a funnel or a hole in a card so designed that the test object can be seen through the device only with one eye. But with a free-choice test the subject is free to choose any point, either between or directly before the eyes, when aligning the tip of a vertical rod with the test object. It was proposed that the Porta-Rosenbach test would prove more valid than the Miles test because it thus allowed for intermediate sighting positions.

The criterion selected was the bombsight design preference of Air Force bombardiers. They were questioned about both the binocular K-system and the monocular Norden bombsight.

In the K-System different target images, one radar and the other optical, are presented simultaneously to the two eyes, and the operator usually prefers that the optical image be the more advantageously presented. Operators were therefore asked to indicate how far to the right or left they would prefer the optics on an ideal design configuration. These data for 103 operators were then correlated with the degree of ocular dominance determined by the Rosenbach test and by the Miles test. It was found that the forced-choice test correlated .43 with the criterion and the free-choice test correlated .65. There was also a modest correlation (.37) between difficulty in winking and bombsight design preference, since some operators prefer to close the eye easier to wink when sighting. When this factor was partialed from the data the correlations cited dropped from .43 to .41 and from .65 to .63.

Bombardiers were also asked which eye they used with the Norden bombsight. This usage report correlated .31 with the Miles test and .63 with the Rosenbach test.

For both bombsights the difference between the two tests is significant at well beyond the 1 per cent level of confidence.

It was concluded that the Miles test of ocular dominance is less valid than the Rosenbach test. Examination of certain data in the literature shows better inter-test correlation between free-choice tests than between forced-choice tests, both of these correlations being better than that found between mixtures of forced and free-choice tests. It is therefore concluded that ocular dominance, where determined by a free-choice method such as the Porta-Rosenbach test, is a more unitary trait than has been indicated by conflicting tests results previously reported. 140 pages. $1.75. MicA54-1319

THE RELATIVE EFFECTIVENESS OF DIFFERING VISUAL PRESENTATIONS OF A COMPLEX AIRCRAFT SYSTEM IN THREE LEARNING SITUATIONS

(Publication No. 8143)

Robert Alden Swanson, Ph.D.
University of Minnesota, 1954

The purpose of this study was to investigate the relative effectiveness of an animated panel, a set of charts, a cutaway trainer, a non-operating trainer, an operating trainer, and a symbolic presentation. These aids were designed to depict as completely as possible, within the limits of its capabilities, pertinent course objectives concerned with a specific portion of the B-47 hydraulic system. The course objectives in this experiment were similar to those included in the B-47 familiarization training course provided by Air Force Mobile Training Detachments. The men used as subjects were skilled airplane and engine me-

chanics familiar with maintenance problems on earlier types of aircraft, but who had had no training or experience on the B-47. Data were collected at four Air Force bases and a total of 735 men participated in one of three experimental situations: "Lecture Demonstration," "Outline," or "Alone." The "Lecture Demonstration" procedure utilized an instructor who delivered the same lecture with each of the six devices. In the "Outline" situation, one student at a time was provided with a lecture outline but with no other oral or written explanation of the B-47 system and then studied one or another of the first four devices listed above. In the "Alone" situation, one student at a time, with no oral or written explanation of the B-47 system, studied one or another of the first four aids listed above.

In all three of these situations the achievement examination on the B-47 hydraulic system was administered to the men while the pertinent training device was in the classroom.

Approximately six weeks after this experimental testing had occurred, the available men (486) were retested.

When the data were analyzed, the following results were obtained:

1. Among the three F ratios concerned with device variance in the three experimental situations under immediate and delayed recall circumstances, none was significant at the .05 level.

2. When differences among devices were considered in terms of the amount of information forgotten over a six weeks' period, no F ratios, significant at the .05 level, were found for any of the three situations.

These results do not provide evidence to indicate that there are differences in effectiveness among the six devices used in the "Lecture Demonstration," and the four devices used in the "Outline" and "Alone" situations when employed to assist skilled mechanics in the learning of the course content considered in this study.

It is important, however, in interpreting these results to bear in mind certain limitations:

1. This study was concerned with a single system (hydraulics) on one type of aircraft (B-47). To the extent that other aircraft systems on the B-47 and systems on other aircraft differ from the B-47 hydraulic system the results will be less likely to be applicable.

2. Certain potential uses of the various aids were not fully exploited. For example, the effectiveness of the trainers in providing information regarding physical appearance of components as well as manual operations in maintenance procedures was not taught or tested.

3. The men used in this experiment were skilled mechanics. The results are, therefore, applicable only to this group of Air Force personnel.

4. Each of the devices was designed to present pertinent information regarding a specified group of course objectives in the most effective manner possible with that device. Little is currently known regarding those factors which make devices most helpful to students. It therefore follows that each of the devices falls somewhere along a continuum of effectiveness for that device. Lack of information prevents identification, with certainty, of these points on the several continua.

131 pages. $1.64. MicA54-1472

SEX DIFFERENCES IN PROBLEM SOLVING

(Publication No. 8223)

Edward Joseph Sweeney, Ph.D.
Stanford University, 1954

Four studies are reported which were designed to provide data relevant to one or more of the following five questions concerning differences between men and women in achievement in problem solving:

(a) Can the kinds of sex differences in problem solving previously reported be verified?
(b) Can differences in problem solving be demonstrated for groups of men and women matched with respect to general intelligence?
(c) Can sex differences in problem solving demonstrated for groups equal in intelligence be accounted for in terms of differences in various special abilities?
(d) To what extent can sex differences in problem solving not otherwise explained be accounted for in terms of differences in specific knowledge or training?
(e) What characteristic or characteristics are common to problems on which sex differences are obtained which are not accounted for by differences in intelligence, special abilities, or specific knowledge?

The data obtained support the conclusion that there are sex differences in achievement in problem solving which are not accounted for by differences in intelligence in the groups compared or by known sex differences in special abilities or specific knowledge. A loading on the general reasoning factor is characteristic of one group of problems on which such differences were obtained. Results obtained with three other general kinds of problems confirm the hypothesis that sex differences will occur in problems which involve difficulties in restructuring, but not in problems which lack such difficulties.

85 pages. $1.06. MicA54-1473

INCIDENTAL LEARNING IN SCHIZOPHRENICS

(Publication No. 8060)

Harold R. Winer, Ph.D.
Purdue University, 1954

Major Professor: Franklin J. Shaw

The general purpose of this experiment was to investigate incidental learning as it may relate to adjustment. This study was specifically designed to test the hypothesis that incidental learning characterizes behavior in normal human beings to a greater degree than in hospitalized schizophrenic individuals.

Fifty-two white, male war veterans served as subjects in the experiment: 14 each in the normal, paranoid, and hebephrenic groups; and 10 in the catatonic group. A manipulative sorting task was used as a subterfuge to avoid intentional learning. Then a test was made of recall of incidental cues relating to the task itself, the examiner's person, and the environment.

The results of the three tests of incidental learning were quantified on the basis of an item analysis and converted into standard scores. The hypotheses were tested with a two-way classification analysis of variance. Three different tests of incidental learning made up one variable while the four different nosological groups made up the other. A covariance adjustment was made to control ability and cooperation among the subjects as represented by differences in manipulative sorting skill.

The statistical analysis partially confirmed the hypothesis, i.e., differences between diagnostic groups were found significant beyond the .05 level of probability. The one important exception was the paranoid group which did as well as, and was indistinguishable from the normal. No differences were found between the three tests of incidental learning. Some qualitative observations were made and suggestions presented for additional research.

44 pages. $1.00. MicA54-1474

RELIGION

THE PRE-LITERARY DEVELOPMENT OF THE KERYGMA

(Publication No. 8185)

Donald Joseph Selby, Ph.D.
Boston University School of Theology, 1954

This study is an attempt to describe the development of the preaching of the early Christians which was addressed to non-believers with a view to persuading them to accept the Christian Way. This preaching was known as kerygma.

The study proceeds, by a classified analysis of all the passages in the New Testament which provide any relevant information, to seek the nature and inner logic of the kerygma by which its development into the forms in which it is found in the New Testament can be retraced.

Among the items which, according to the evidence, occurred in the various manifestations of apostolic preaching, there are five mentioned with significantly greater frequency than the rest. They are: 1. The Scriptural prophecies fulfilled in Jesus; 2. The Messiahship of Jesus; 3. His crucifixion; 4. His resurrection; 5. An appeal for faith in Him. Also, the items found in the evidence contain certain natural connections of ideas which allow them to be grouped into larger categories. These categories may be listed as follows: The background of Jesus' advent; His Messianic character; His life history; His effect on believers; His eschatological role; the appeal of the kerygma; the cosmic significance of the kerygma.

The pattern formed by these categories is found in all levels and types of the evidence, which indicates its importance for understanding the kerygma. Judging by the frequency of occurrence and position in this pattern, the items that seem to be of the greatest significance are: The Messiahship of Jesus; His crucifixion and resurrection; The call to repentance and belief.

A study of preaching in the Synoptic Gospels reveals the following motif: The imminence of the eschaton and the coming of the messiah are appealed to as motives for repentance and baptism. An analysis of the total evidence leads to the conclusion that the nature of the kerygma, which follows, essentially, the motif of the Synoptics, is to be discovered by observing the steps in the logic of its argument, which somehow proceeds from certain statements about Jesus to an appeal for repentance, faith, and a new ethical relationship to God. In the course of this argument, two steps are characteristically included: 1. The attribution of a Messianic role to Jesus; 2. His crucifixion and resurrection.

The aim of the kerygma, following the preaching of Jesus Himself, was ethical from the first. The argument always began with Jesus. The fundamental change that occurred between the preaching of Jesus and the apostolic preaching was the shifting of the emphasis from the kingdom of God to the Messiahship of Jesus. The crucifixion of Jesus was in large part responsible for this.

Lacking Jesus' personal presence, the early preachers appealed to His Messianic role as proof of the "fullness of time" and of the imminence of the eschaton. But the problem of the crucifixion still had to be answered. This was done by the announcement of Jesus' resurrection and the subsequent phenomena of the gifts of the Holy Spirit and the miraculous power resulting from the use of His Name. This answer received confirmation in the discovery that it was just this death and resurrection which had been predicted of the messiah in the Scriptures.

The essential argument remained the same throughout the development of the kerygma: The Messiah is Jesus, the eschaton is coming, therefore, repent, believe, be baptized and receive forgiveness of sins. 219 pages. $2.74. MicA54-1475

SOCIOLOGY, GENERAL

A STUDY OF SOCIAL FACTORS ASSOCIATED WITH RELIGIOSITY AMONG A SAMPLE OF COLLEGE EMPLOYEES

(Publication No. 8144)

Marvin Jacob Taves, Ph.D.
University of Minesota, 1954

It is the dual purpose of this research to explore the problems involved in studying the influence of personal experience on religious attitudes, beliefs, and behavior patterns among non-student adults of all ages and different social classes and to ascertain the relation between several indices of religiosity and such variables as the sex, education, occupation, residence during youth, and age of these subjects.

The sample consists of 162 college employees and was drawn by selecting every fifth name from the 1949-50 Washington State College staff directory, which lists professional, clerical, and maintenance staffs.

Methodologically the study relies more extensively on memory of personal experiences than have previous studies of this type. It incorporates several new research tools — (1) a rank ordering of church groups according to social status on the basis of responses to a questionnaire, (2) an index of favorableness toward the church, and (3) an index of conservatism-liberalism of religious beliefs. The questionnaire incorporates a format and organization found conducive to recall.

Relations between the more general indices of religiosity and the other variables are considered first; then the nature of associations between orthodoxy on nine major beliefs and the independent variables is examined.

Findings which meet the criterion of statistical significance are projected to the sampled universe and related to previous research.

The generalizations are that women attend church and engage in prayer more often, their attitude toward the church is more favorable, and they are more orthodox (conservative), than men.

Religiosity and education are significantly associated on only two comparisons. On these the men rate themselves less active and respond in a less orthodox fashion to statements of religious beliefs as they rise in education.

On occupation only one significant association with religiosity appears. The low occupation men score more orthodox than the high.

Rural rearing is associated with frequent office holding among women, greater church participation among both men and women, and a greater orthodoxy of belief among men.

As regards age, among the men there is a tendency to rate oneself more active in the church and more orthodox in belief during youth than later. Women tend toward greater church participation with increasing age.

In summary, sex and residence each show four significant associations with general indices of religiosity. Age is thus associated in three instances, education in two, and occupation in one. It would seem logical to generalize that sex, residence, and age tend to influence religious behavior more strongly than do education or occupation.

The three "beliefs" concepts which most frequently show significant association with independent factors are immortality, explanation of orderliness in nature, and relationship of science and religion. Except for the relationship of the last concept with occupation, the direction of association is positive on sex, negative on education, and positive on residence or age, as this direction was defined in the study.

262 pages. $3.28. MicA54-1476

SPEECH-THEATER

THE RHETORICAL THEORY OF HUGH BLAIR

(Publication No. 7556)

Herman Cohen, Ph.D.
State University of Iowa, 1954

Chairman: Professor Orville A. Hitchcock

The purpose of this study was to investigate the rhetorical theory of Hugh Blair. Dr. Blair was born in 1718 and died in 1800. From 1757 to 1796 he was minister of the High Church of St. Giles in Edinburgh. Between the years 1754 and 1783 he lectured on Rhetoric at the University of Edinburgh.

In his day Blair enjoyed a tremendous reputation as a teacher of rhetoric, preacher, and intellectual figure. Among his close associates were most of the important British intellectuals of the time.

Blair's rhetorical theories are contained primarily in his Lectures on Rhetoric and Belles Lettres, published in 1783. The Lectures exercised a profound influence in Blair's day and in the period following. His text on rhetoric was reissued many times, in Britain and throughout the world. In the first half of the nineteenth century Blair's Lectures was used in practically all of the English and American universities.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Blair's rhetorical theory has not been studied previously. The several biographers do not deal with his theory of public address. The studies in Speech are more largely concerned with Blair's speaking than with his theory of rhetoric. This investigator believes that an examination of Blair's ideas concerning rhetoric will substantially supplement the conclusions of the earlier studies.

The author examined carefully the writings of Blair himself and of Blair's predecessors and contemporaries who dealt with aspects of rhetorical theory. He read widely in the periodicals, letters, diaries and journals of the time. He sought to examine Blair in the light of the forces at work in the period in which he lived and the heritage which came to that period out of the past. The investigation proposed to determine the nature of Blair's ideas concerning public address. It sought to isolate the major divisions of Blair's theory in order to examine his basic postulates with regard to rhetoric and to come to conclusions concerning their sources and possible contributions. In attempting to determine the sources of Blair's ideas, the writer gave consideration, not only to possible contemporary influences, both British and Continental, but also to the influences of the classical rhetoricians of Greece and Rome. An attempt was made also to isolate the unique characteristics of Blair's rhetoric, the contributions which he made to rhetorical theory.

Blair's work is essentially a re-writing, for the eighteenth century audience, of the principles of rhetoric set forth in classical times by the Greek and Roman writers. Blair was heavily dependent, in particular, upon the writings of Quintilian. He was more selectively dependent upon the writings of Cicero and Aristotle. Blair also drew materials from the writings of his contemporaries, some directly concerned with speech, and some from other disciplines. Among those who influenced him most were Sheridan, Lord Kames, Hume and Reynolds. Blair was not an indiscriminate borrower, rather his theory is a synthesis of selected views of other authorities. His point of view was essentially that of the period in which he lived, the Age of Reason. Thus, it was characterized by a highly rational approach.

In spite of its derivative nature, Blair's Lectures on Rhetoric and Belles Lettres embodies several major contributions to rhetorical theory. Blair was unique in that he was one of the first major writers to direct his rhetoric not only to the practitioner but also to the listerer as a critic. The most pervasive characteristic of Blair's criticism is the application of the principles of speech composition which are outlined in the didactic sections of the Lectures. His critical method also reflects his basic concept that all eloquence must be functional and that the highest goal of eloquence is persuasion. He, therefore, seeks to determine, in his critical system, whether the orator under consideration uses rhetoric to elicit a response or merely for sake of ostentation, pomp, and style.

Closely related to Blair's contribution in the area of criticism is his contribution in the field of taste. Blair's critical canons grew out of a firm belief that the development of rhetorical criticism must find its foundation in the understanding and improvement of human taste. Criticism for him is the application of good taste to the various species of oral discourse.

His concept is one which holds that taste is an innate but precisely improvable faculty. The criterion which he proposes is the neo-classical standard of "the taste of men in general". That must be held to be the most beautiful or most good on which the most human beings concur in admiring. Blair applies this principle to rhetorical criticism.

Another of Blair's contributions to rhetorical theory is his concept of oral style. It is from a perspective which regards perspicuity as the fundamental characteristic of style that Blair discusses oral language. Ornament is desirable; clarity is essential. A unique aspect of Blair's view of oral style is its relationship to other rhetorical factors. He regards style as relatively meaningless unless it is closely related to the individual speaker and his peculiar methods of thought. In addition, Blair views style as being closely related to all of the other elements of speech composition.

The last of Blair's major contributions is his thesis, posited in his discussion of the history of oratory, that eloquence thrives in free societies and decays when liberty is removed. Blair finds that Grecian eloquence first appeared with the rise of the democratic Greek state. Athenian eloquence came into being with the birth of the republic and decayed with its death. Similarly, it was the short duration of democracy in Rome which caused its oratorical excellence to be so short-lived. Even in his own time, Blair points out, true eloquence is found only in societies where free expression is permitted.

The overall dimension of Blair's contribution to rhetorical theory and criticism is not inconsiderable. The analysis of The Lectures on Rhetoric and Belles Lettres leads the writer to list the following distinctive features: (1) his utilization of the precepts of rhetoric for the critic as well as the speaker; (2) his application of the principles of taste to rhetorical criticism; (3) his conception of a perspicuous oral style, closely related to the speaker, subject and audience; and (4) his establishment of the relationship between freedom and eloquence in his discussion of the history of oratory.

480 pages. $6.00. MicA54-1477

AN OBJECTIVE AND COMPARATIVE STUDY OF FIVE METHODS OF TRANSMITTING INFORMATION TO BUSINESS AND INDUSTRIAL EMPLOYEES

(Publication No. 8036)

Thomas Locke Dahle, Ph.D.
Purdue University, 1954

Major Professor: P. E. Lull

The purpose of this study was to measure objectively the relative effectiveness of the following five

methods of transmitting information to business and industrial employees:

a. Oral only
b. Written only
c. Combined oral and written
d. Bulletin board
e. Grapevine only (control groups)

In methods a,b,c, and d, a deliberate effort was made to transmit information. In method e, no information was transmitted other than by the operation of what is commonly referred to as the "grapevine". This method was used on a control-group since this factor was operative in all groups involved.

These aspects of the problem were investigated:

1. Which of the five methods listed above would produce the best results as measured in terms of correct answers to test questions?
2. What differences in the results can be attributed to the time of presentation of the material?
3. How does length of service affect results obtained?
4. How do results obtained from a business and industrial population compare or contrast with results obtained from a student population?

In order to examine the effectiveness of these five methods of communication three separate experiments were performed.

The preliminary experiment which set the pattern for the two experiments which were to follow was performed with a group of 1030 undergraduate students of Purdue University. Information contained in the syllabus of a beginning speech course in which these students were enrolled was presented to them by seven different methods.

On the third meeting of each class following presentation of the material a ten-question multiple choice test based upon the information contained in the syllabus was administered.

The industrial experiment was conducted with a group of 84 employees in the operating departments of the Rostone Corporation. Information relating to insurance benefits was extracted from the company handbook and transmitted to the subjects by four methods of communication.

On the third day following presentation of the material a ten-question multiple choice test based upon the information transmitted was administered.

The business experiment was conducted with a group of 528 employees of Spiegal, Inc. Information pertaining to company benefits was extracted from the company handbook and transmitted to the experimental group by the five methods previously listed.

The testing procedures and statistical analyses of the data were similar in all three experiments.

In each experiment the analysis of the relative effectiveness of the methods indicated statistically significant differences in results when material was presented using the different methods.

It was found that:

1. The methods of transmission tested ranked in the following order:

Most effective	a. Combined oral and written
	b. Oral only
	c. Written only
	d. Bulletin board
Least effective (no better than chance)	e. Grapevine (control groups)

2. The time variable was not a statistically significant factor in determining the amount and accuracy of the information transmitted.
3. Regardless of method used, old (more than one year) employees scored higher than new (less than one year) employees.
4. Results obtained from industrial and business populations are similar to those obtained from a student population.

The ranking of the methods as to effectiveness in transmission was similar in all three experiments. The only exception occurred in the industrial experiment where results obtained from the combined oral and written method and the oral only method appeared to be the same unless the effects of old and new employees were taken into account.

The procedure for testing communication reported in this study would seem to be adaptable to many business and industrial situations where suitable testing materials could be found.

An extensive review of the literature related to communications in business and industry is also included in this study.

226 pages. $2.83. MicA54-1478

JOHN BROUGHAM AS AMERICAN PLAYWRIGHT AND MAN OF THE THEATRE

(Publication No. 7494)

David Stewart Hawes, Ph.D.
Stanford University, 1954

In 1842, John Brougham, a vigorous and gifted Irishman dedicated to work in the theatre, came to America. As a fecund playwright and versatile man of the theatre he made many contributions to American theatre and drama during thirty-three years of strenuous work in his adopted country. Yet about his career and his considerable achievements no accurate and comprehensive exposition and evaluation has ever been attempted. There was a need for a detailed and consecutive exposition of Brougham's activities as an actor, as a theatre-manager, and as a playwright. To satisfy such needs has been the purpose of this study.

During his fifty years as an actor Brougham interpreted well over one-hundred different characters representing an extensive diversity of personations. Possessing expert knowledge of all "lines of business" featured in nineteenth-century stock companies, he was particularly skillful as a low-comedian and light-comedian. Although especially expert at portraying comic Irish gentlemen, he also presented with great popular success a variety of droll creations from his own burlesques and extravaganzas. Some of Brougham's later stage portraits of professional men adumbrated a more

realistic approach to problems of acting. His skill and popularity as an actor made him a featured performer in the best stock companies of America, especially in New York, Philadelphia, and Boston; and starring engagements, usually in a repertoire of his own plays, often carried him on triumphant — and lucrative — tours throughout the country. Brougham counted among his close friends most of the outstanding actors, theatre-managers, and playwrights of his time; while to generations of American theatre-goers he became a familiar figure, loved and respected as few other actors of the century.

Brougham's study and practice of acting and his activity as a playwright frequently interlocked. He appeared as an actor in the first productions of many of the plays he wrote, usually portraying a character he had created for his own interpretation. He also wrote many plays tailored to suit the peculiar gifts and techniques of other star actors, and he did much distinguished work as a stock-company playwright. As a dramatist Brougham participated in many of the important developments in American drama during the nineteenth century. In the complete span of his career he wrote over one-hundred and twenty-five dramatic pieces, a volume of work hardly matched by any other American playwright of the century; and many of his plays were produced frequently in theatres throughout America, and in England. His creative activity was especially varied and voluminous between 1842 and 1860. In his constant search for dramatic materials, Brougham discovered a diversity of subjects that appealed to American audiences, and he presented his subject-matter in a wide variety of forms and types of drama, such as romantic tragedy, social comedies, various types of melodrama, farces, extravaganzas, burlesques, and dramatic novelties. Some of his social comedies represent valuable contributions to the satiric and realistic treatment of American mores and customs in American drama, and Brougham's careful and extensive employment of external realistic details of characterization and spectacle in his melodramas and later comedies mark him as a transitional playwright in the movement from romanticism to realism in American drama. But it was in the creation of extravaganzas and burlesques that Brougham identified himself and his work most closely and provocatively with social, political, and literary elements of American society. Protected by a dazzling shield of drollery, he criticized, sometimes with savage sting, certain corrosive elements of American society and the skill and tact with which his comic creations with serious intent earned for him Laurence Hutton's accolade as the Aristophanes of America. Furthermore, the structural characteristics and the substance of Brougham's burlesques and extravaganzas reveal one possible source and impetus for later distinctive developments in American musical comedy, musical reviews, variety shows, and vaudeville.

Sometimes to the activities of playwright and actor, Brougham added the duties of a theatre-manager. He failed, however, in all three of his major ventures in theatre management. He was unsuccessful chiefly because he had little business ability, and over-reached even his remarkable vitality and industry by trying to encompass simultaneously the strenuous labors of an actor, a playwright, and a theatre-manager. But in spite of deleterious limitations in certain phases of his work, a considered evaluation of his over-all activities and accomplishments reveals John Brougham as a significant American playwright and man of the theatre.

686 pages. $8.58. MicA54-1479

THE RELATION OF DRAMATIC STRUCTURE TO COMEDY IN THE PLAYS OF GEORGE BERNARD SHAW

(Publication No. 8222)

William Leslie Sharp, Ph.D.
Stanford University, 1954

The purpose of this study is to examine in some detail the structure of Shaw's plays and find out, if possible, what in that structure promotes comedy. Shaw has been studied as a thinker, but little attention has been paid to his actual method of dramatic composition. In an attempt to delineate the method of Shaw's composition, it has been found that Shaw's plays are organized in three distinct manners. There are those plays in which the organizing principle, the means of focusing audience attention and interest, is the action. In these plays the major dramatic question is in terms of what will happen next. An obvious example of this organization in Shaw's work is Man and Superman in which one's major dramatic interest is when and how Ann Whitefield will finally catch Jack Tanner. A second method of organization used by Shaw is in terms of character development. In these plays the major dramatic question is in terms of what kind of person the protagonist is or what kind of a person he will become. The growth of Eliza in Pygmalion from flower girl to lady is of greater interest than any single question of what might happen to her. The third method of organization used by Shaw is in terms of thought or idea. In these plays the major dramatic question is in terms of what the problem or issue presented is. Such is the organization in Getting Married, in which the major question is what can be done about the marriage laws. Neither the action nor the characters in the play are as important as the answer to this question.

Each of these methods of organization demands differences in characterization, differences in dialogue, and differences in the kind of action dramatized. Each uses somewhat different methods of creating comedy, although the use of the paradox is common to all three. In the first group, however, there is some evidence of inherently comic situation which is not in evidence in the other two groups. In both of the first two groups well-rounded, believable characters are presented. This is of particular necessity in the second group since the major interest is in terms of characters. If they are to be important enough to concern an audience, they

must have a marked degree of believability and similarity to real people. This is not true in a play like Misalliance or Getting Married in which interesting personalities might very well weaken one's interest in the issues they have been created to illustrate. In this group of plays comedy is created to a large extent by the paradoxical and unexpected reversal of the expected view on any given issue.

The study attempts some re-evaluation of Shaw's comic genius by sharp delineation of the devices he uses. Recent critics, such as Edmund Wilson and Eric Bentley, have pointed out certain limitations in Shaw's philosophical and political views, but they have not shown the advantage of these limitations to his comic artistry. No thorough analysis of his thinking has been attempted in this dissertation, but close analysis of the plays alone shows certain definite philosophical contradictions that are necessary for the creation of his particular kind of comedy. His ability to see both sides of most of the issues he dealt with allows him to laugh at the extremes that any thoroughly consistent philosophy might lead to. Part of Shaw's comic genius is possible only because of certain of these political or philosophical inconsistencies. This study attempts by an analysis of how his plays are put together to show some of the ways in which this comic talent works.

262 pages. $3.28. MicA54-1480

ZOOLOGY

AN ECOLOGICAL STUDY OF THE FAMILY TENDIPEDIDAE OF TWO FRESH-WATER LAKES IN ISABELLA COUNTY, MICHIGAN

(Publication No. 8064)

La Verne Leon Curry, Ph.D.
Michigan State College, 1952

An ecological study of the Family Tendipedidae (Diptera) covering a period of four years was made on Campau and Coldwater Lakes located in Isabella County, Michigan. Chemical and physical data concerning the limnology of the two lakes are presented, and the midge fauna within each is treated both qualitatively and quantitatively.

The midge fauna is discussed according to depth distribution of the various species within each body of water. The distribution within Campau Lake is given for each two meters of depth, and in Coldwater Lake for each five meters of depth. From these data bottom preference for some species are noted. Estimations of numbers of generations per year are given for Tendipes plumosus, T. decorus, T. staegeri, T. atroviridis, and Pelopia vilipennis. Annual life cycle trends are predicted for T. tendipediformis, T. nervosus, and T. ochreatus, Species believed to have but a single generation per year are T. plumosus, T. atroviridis, and T. nervosus, while T. tendipediformis, T. decorus, and T. staegeri have two generations per year.

The volume of the standing crop of Tendipedidae for the various seasons of the year was found to be greater within the sublittoral and upper limits of the profundal zone than in the littoral zone. This is due to the presence of larger species of larvae inhabiting the deeper sections of the lakes investigated. Large numbers of larvae were found to occupy relatively small areas of profundal mud in both lakes. These dense populations are termed "concentration zones", and appear to be caused by such factors as steepness of slope, proximity of plants, and the action of waves and wind in the littoral zone. Evidence from the volumetric analysis shows that there is no migration of the larvae of T. decorus or T. staegeri. Statistical analysis of the sampling data confirm the assumption that stations of comparable depth in the two lakes are ecologically dissimilar.

204 pages. $2.55. MicA54-1481

A STUDY OF THE MOUTH PARTS OF CERTAIN MOSQUITO LARVAE AND THEIR IMPORTANCE IN TAXONOMY (DIPTERA: CULICIDAE)

(Publication No. 7870)

Abdel Salam Mahmoud Shalaby, Ph.D.
University of Illinois, 1954

The anatomy of the mouth parts of the larvae of Anopheles quadrimaculatus, Aedes aegypti, Culex quinquefasciatus, Psorophora ciliata and Psorophora howardii, in their various stages of development, was studied.

The larvae of A. quadrimaculatus and C. quinquefasciatus have the filtering feeding habit. The larvae of A. aegypti have the grazing feeding habit. The first instar larvae of P. ciliata and P. howardii have the filtering feeding habit. They become predators and feed on other mosquito larvae after the first larval moult.

The mouth parts consist of the labrum, mandibles, maxillae and the complex labium. The labrum of the species discussed, in all instars, consists of a disomedian palatum and two disto-lateral labral brushes. The labral brushes, in all the instars of A. quadrimaculatus and C. quinquefasciatus as well as those of the first instar larvae of P. ciliata and P. howardii possess simple hairs. The labral brushes of A. aegypti, in all instars, possess both simple and pectinate hairs. Those of the second, third and fourth instars of P. ciliata and P. howardii consist entirely of serrated hairs.

The epipharynx is located on the ental surface of the labrum. It consists of an epipharyngeal sclerite, epipharyngeal hairs which vary among the species and the instars of one species and the epipharyngeal processes which may or may not be present.

The mandibles of the predacious instars of P. ciliata and P. howardii, are strong and provided with strong, serrated dentes. A mandibular brush is present in the mandibles of A. quadrimaculatus, C. quinquefasciatus and A. aegypti. However, in A. aegypti there is a mandibular comb in addition to the brush. The brush is absent in the mandibles of P. ciliata and P. howardii and a comb is present at the meso-cephalic region of the mandible.

The maxilla is composed of a fused cardostipes, galea, lacinia, palpus and palpifer. The palpifer is absent in the maxilla of A. quadrimaculatus. A maxillary brush is present in A. aegypti, C. quinquefasciatus and the first instar larvae of P. ciliata and P. howardii. It is absent in A. quadrimaculatus and is replaced by three short combs in the second, third, and fourth instars of P. ciliata and P. howardii.

The labium is greatly modified and complex. It consists of the submentum, mentum, glossa and paraglossa. The glossa is absent in the various instars of P. ciliata and P. howardii. In A. quadrimaculatus the glossa is triangular and provided with six blunt projections in the first instar and eight in the advanced instars. In A. aegypti and C. quinquefasciatus the glossa is semi-oval and fringed with pectinate hairs in A. aegypti and bipectinate hairs in C. quinquefasciatus The mentum of the predacious instars of P. ciliata and P. howardii is orovided with teeth, while those of the first instar and those of the other species do not possess teeth. The paraglossa is toothed and is the most highly sclerotized and pigmented part of the labium.

The hypopharynx is spiny, pigmented and sclerotized and is located dorsad of the paraglossa.

The first instar larvae of all the species can be easily distinguished by the egg bursters on the frons. These egg bursters vary in shape and structure in the species discussed.

Because of the differences shown, it has been possible to construct keys to distinguish the five species considered, as well as keys to separate the instars of these species.

480 pages. $6.00. MicA54-1482

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.